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E-TRANSPARENCY: PUBLIC TRUST TRANSFORMATION WITHIN E-GOVERNMENT

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Abstract

The constant development of technology in the accompanying e-government has a significancepredispose on various possibilities for applying innovative development concepts based on internet related online for transparancy. This paper redraws empirical evidence about public trust transformation. Social media as part of internet networking can be used for government regulation process in the internet community.Using a qualitative research and the primary data was collected through a questionnaire, in this case social networking purpose, strategy and social networking usability has relevant influence to competitive advantage. Government decision for creatinga relationshipwith social media might be part of the solution to create new job and transform companies from common way to build government regulation using social networking technology on internet world. Bear in mind that internet increasingly being viewed as a tool and a place to enhance public information as common knowledge.However, lack of trust found people not trust any regulation and performance while the information strictly hidden from public.The result found which less transparancy in the online platform such social media and website as part of e-government make it more difficult to establish trust with the society, in the future government should make policy based on trust and fittest regulation using e-transparancy as alternative tools for governing.

Keywords: e-government, social media, information and regulation,competitive advantage, public services

INTRODUCTION

The modern world has been dramatically transformed. In this new world of today, socioeconomic, political and environmental problems have been redefined in terms of global connection. Since beginning of the internet era, peoples are congregating on the Internet, and they spend a great amount of time online, searching information, exchanging news, opinions , socializing in social media , chat rooms even doing government regulation. Millions of people throughout the world use the Internet in a variety of ways, and some of them made success. Developing system for government on the internet can create controversy, raising the question reveals differences among bad and positive impact. As mentioned, many of tactical rulingsolutions while we do some activity on the internet becoming tools of doing e-government. Actually is kind of smart solution while the infrastructure of technology already supported, person involve in e-government operation in a wide range of fields. Social networking and website becoming an important strategic resource and the ability to acquire and developgovernment regulation, share it and apply it can lead to sustainable competitive advantages. This is because wide networking can contribute to traditional resources and assets in new and distinctive ways and thereby provide superior value to public expectation (Teece et al., 1997).

The ability to create networking and to continue learning from it can become a value added because the social network developed today will become the core of government regulation of tomorrow (Grant, 1996). In recent years they realize that networking plays a key role in developing government regulation processes (Dous et al. 2005). While the internet is focusing on the e-government about the public expectation to manage customer interactions, social networking systems can manage that situation through the process of creating, structuring, disseminating and applying it to enhance government regulation performance and create value (Bose &Sugumaran, 2003).

e-government success in a customer-centric government regulation environment is only possible by integrating it with networking systems to create what is known as e-government enabled e-government processes. Nowadays, researchers propose that e-government part of e government regulation is the way to succeed. Social media usability is an area of e-government where e-government instruments and procedures are applied to support it as the utilization of e-government for, from and about public expectation in order to enhance relating capability of users.

METHODOLOGY

Since the purpose of our study is to provide a better understanding of a relatively growing topic in order to get insight about it, we using descriptive analysis and also placed as exploratory. The fact that our research questions are formulated in a way that further research can be conducted also indicates an exploratory approach in our study. The study involved an analysis of data obtained from 120 individual interviewees. Aged from 20 to 40, and were internet user. All of them were social media government regulation users with different usage patterns, each interview was conducted for around 3 simple questions. An online questionnaire, beginning with easy questions, then moving on to more sensitive or personal issues, and concluding the interview again with comfortable questions, and the request for a possible follow-up.

Study participants were asked a variety of questions related to usage purposes, strategy, and social media usability for government regulation (interest in social media government regulation as a create relationship and social networking supported marketing for their product or services. The interviews consisted of structured questions as well as ad-hoc follow-up questions. To encourage the interviewees to freely express themselves (Neuman,1997).

RESULT FINDINGS

Social media as government Information tools

Interview discussions revealed that it was meaningful to differentiate social media government regulation users into different groups based on their usage intensity and this categorization revealed several other distinguishing characteristics. Based on usage intensity, categorized into three types :Active or habit users were the highest intensity users, who apparently had formed a strong habit of visiting their social media government regulation or social media government regulation made deep relation and sharing with their friends ; Passive user, less posting and active to use comment or check their friend, existing part of relationship, and keep their relation with daily comment ; Social media walker, is floating mass of user, they just passing through without left any comment, for some reason this happened because some of entries posting for social media is not interesting or they don’t have any relationship beside online meeting.

Social media Reality

Social media government regulation could have a main role in small and medium enterprises which using social media as their marketing tools. Possibility an economic transaction via online by providing them the opportunity to engage with public expectation and trading system.

Social media government regulation could be used at all levels but, We can argue that it would be more effective when trust and services mixed integrally. Using social media government regulation in blended marketing could help social media user to get a suitable strategyfor selling their product or services. Many social networking such Facebook.com or twitterencourages user to participate in social media,discussion groups and to draw market listing to the viewer.This can help small and medium enterprises to grow up side by side with adaptive technology. Social media government regulationis a dynamic place that users could make communities on it, with their friends , trader, costumer from othersall over the world.

Table 1. Characteristics of the respondents and social media user bypurposes

Variable	Frequency	Percentage (%)
Gender		
Male	70	58,3
Female	50	41,7
Age		
20-29	60	50
30-40	60	50
Education		
High school	25	20,8
University Graduate	95	79,2

Purposes	Frequency	Percentage (%)
Life style	13	10,8
News and information	38	31,6
Leisure time	10	8,3
Networking	59	49,1
Total	120	100

Source : Primary Data authors collection, 2017

Social media for government regulation purposed influences to the online community and it also influenced the way in they usingsocial media.User decision to being traded online have to understand E-government system and apply at social media government regulation. Social media in Indonesia is not completely online, for example on payment methods they still usea conventional bank as payment and transferring system.

Demographic information about the respondents are given in Table 1. Interviewees describe their purpose to create social media , around 59 people say they need social networking services to build their networking, 38 people for lifestyle, 10 people for leisure times, 13 people for government regulation. They were eager to share (no matter whether within their group of friends or with the general public) and had adopted the web social media software due to some peer pressure. They strongly felt that they should also post to social media government regulation as their friends did. They also considered web,social media as one of the best ways to spend idle time. For this user group, technology features that promoted sociability was of great importance. For example, they would keep lists of friends for continuous interaction, or would use the product review on their social media to inform others or remain informed of changes.

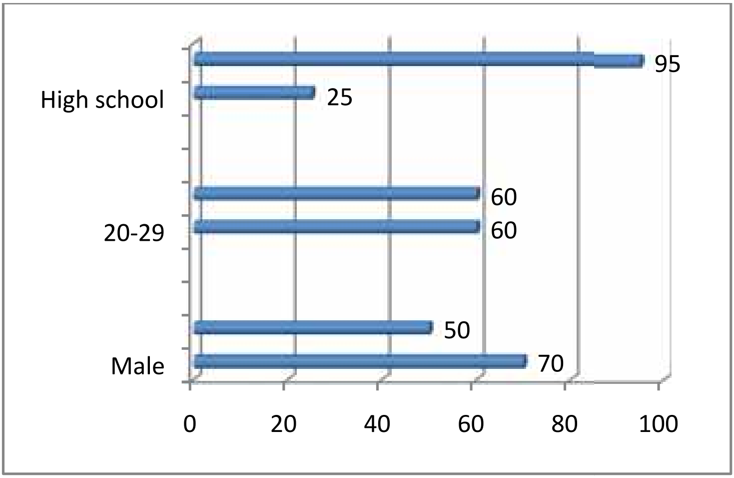

Figure 1. Characteristics of the respondents and ocial media use

For a summary of habitual user characteristics, once every 2 to 3 days, usually during leisure time. Instantly people still don't recognize the power of social media. Social media government regulation can be used by small and medium enterprises to follow online trading based on e-government theory. One possibility is the use of social media as a relationship marketing, where social media user reflects about what they are selling, what they are offering, what they are working on with performance etc. Social media users can introduce this strategy to attract viewers or their contact becoming loyal costumer. Social media user in biggest part of survey 59 people using their social media as networking, this situation also could be used to have a give some guidance and some advantage to offering extra information product and services.

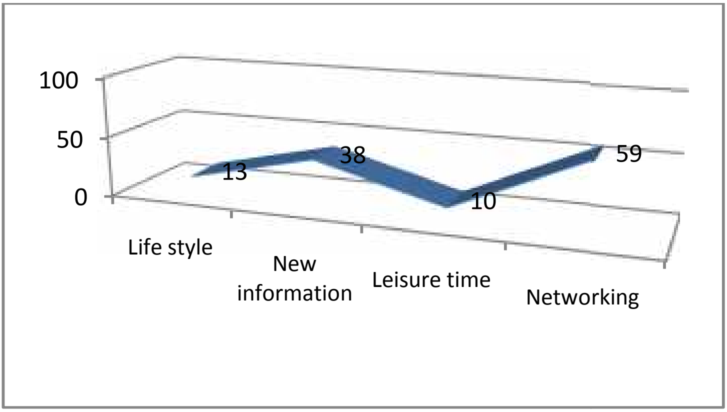

Figure 2. the respondents and social media user by purposes

It is recommended that using successful social media as government regulation tools to be patron to motivate social media users, but it is better to be understood social media users the advantages of using social media, government regulation user can invite the social media readers to access their product and services in their social media, their product or services can be displayed and reviewing. The important thing is to use the social media as a tool not as an aim.

Indonesian social media users strategy

In their need to gain customer attention, Social media users may be able to reap the opportunity offered by social media government regulation. When email became popular as an interpersonal communication medium,companies for better or worse, chose to broadcast their advertising messages through email. However, as the sample of interviewed Indonesian social media demonstrates, this generation of technology users increasingly comparing with email as a communication medium within social media government regulation relationship, while personal conversations occur in and between social media government regulation, relationship becoming main factor to support government regulation on social media .

Hence, for social media user to regain the attention of social media readers, they likely have to adapt themselves. On one hand, they have to recognize that active and habitual social media reader or their contact spend much of their communications focused strategy using by social media government regulation user. On the other hand, social media readers are also a reflection of a new type of Internet user who is interested in more personal and “natural” communication than has been integrated withvirtual communities. Markets are one conversation between trader and people, whether as a user or as public expectation, are increasingly willing to listen to the artificial sounding language of marketing. One of the most favorable strategy is made relationship with people. Becoming related to people is not easy, but in anotherway becoming people to do is more difficult.

Methods for promoting their product, in our research describing in two strategy, which are indirect information and regulation and direct information and regulation.

Table 3. Social media user typical information and regulation strategy

Strategy	Frequency	Percentage (%)
Indirect Information	80	66,6
Direct Information	40	33,4
Total	120	100

Source : Primary Data authors collection, 2017

There are around 120 of the social media users have been answered the question for instance state: There are two conversations one inside the social media government regulation user, and one correlation with the social media reader or customer market. They calculate around 40 people choose direct marketing and agree if their social media , selling directly. These two conversations want to talk to each other. They are speaking the same language". Correspondingly using by 80 people according the challenge for marketing relationship they will be to adopt the social media government regulation medium and trend setter, to interact with the most intensive social media government regulation users, but also to at least change the mode of communication for public expectation becoming used to the "Relationship marketing". It is not surprising then that the Wall Street Journal predicts social media (as well as other online innovations) to revolutionize the way organizations conduct their government regulationes in marketing.

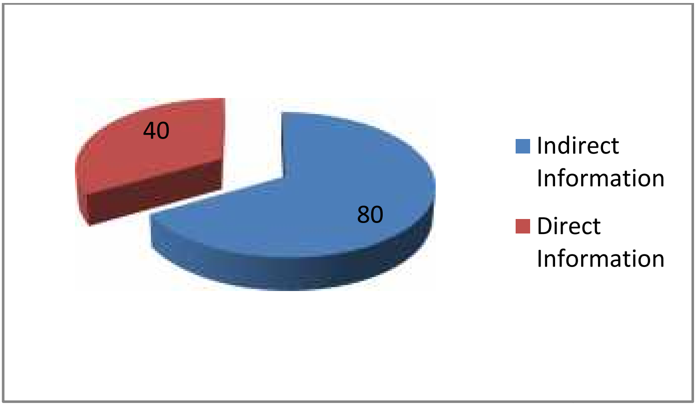

Figure 2. Social media user typical information

Social media usability

Although the interviewee's experience with social media was mostly positive, several identified problem areas. Table 4 shows the opinion of social media users about the degree of problem when they use social media as government regulation tools.

Table 4. Frequently problems with social media

Problem	Never	Seldom	Frequently	Always	Total answers
Learn-ability	3 (2.5%)	2(1.6%)	5(4.2%)	110(91.7%)	120(100%)
Efficiency	33(27.5%)	17(14.2%)	30(25%)	40(33.3%)	120(100%)
Memorability	5(4.2%)	5(4.2%)	10(8.5%)	100(83.1%)	120(100%)
Reliability	40(33.3%)	10(8.5%)	20(16.6%)	50(41.8%)	120(100%)
Subjectiveuse r satisfaction	60(50%)	17 (14.2%)	23 (19.2%)	20 (16.6%)	120(100%)

Source : Primary Data authors collection, 2017

The most frequently mentioned drawback was learned ability, efficiency, memorability, reliability, user satisfaction required to maintain a social media . In term of table 4 ,Nielsen mention usability as quality of user experience during interaction with a system and includes five major characteristic of it (Nielsen ,1992) : Learn-ability, Easy and fast learning using the system; Efficiency, precise and using system to be efficient ; Memorability, easy to remember, remind everything without relearning; Reliability, intention for people to prevent error factor and minimize the error occurrence and maximize the possibility for recovery process from error; subjective user satisfaction, measuring like or dislike user to this system or product, include attitude, perception and feelings.

From a public point of view, one downside has another thing to make sure you keep up and well maintain. Having a social media government regulation version is pretty tough. Some of interviewers think donot want to post something unless it is somewhat newsworthy, and something newsworthy doesnot happen every day, because of selling something they need to mix their ability displaying product on their social media .

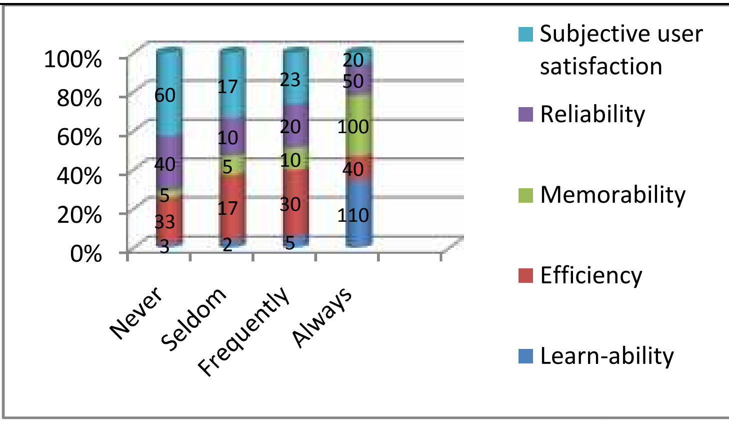

Figure 3. Frequently problems with social media

They all have a ton of other things to do besides post to the social media. Such learning ability most of them have to learn how to use social media and become familiar with it. They have to learn the first operation procedure to build good social media, but in the same way they think this is not efficient, but easy to remember and can use as alternative tools for doing government regulation, even the result still in progress. Efficiency situation between social media and strategy influence by time spent and what kind methodology they have, most of the users are house wife who held their government regulation in small office at home.

Memorability, its mean social media user on this trading online system they become familiar with technology in social media. In social media, user becoming comfortable and supported by a system from their social networking provider, and if they found some errors on their social media, provider has already FAQ page to makethe solution while problem occur. Measuring satisfaction on social media,as their purposes to get customer most of the interviewees, already satisfied for their performance, but for economy result or return of investment, they still have to encourage themselves.

DISCUSSION

With interview findings indicate that use purposes and strategy choices of different users are driven by users' individual or social needs. Others carried out activities (such as commenting) using their ability to display their products and services to attract their contact or customer needs. This empirical model showed significant findings between social media user purpose and strategy to gain added value or competitive advantage. This study confirms the view expressed in much of the published literature that social media have the potential to be an effective marketing and communications tool for small government regulationes.

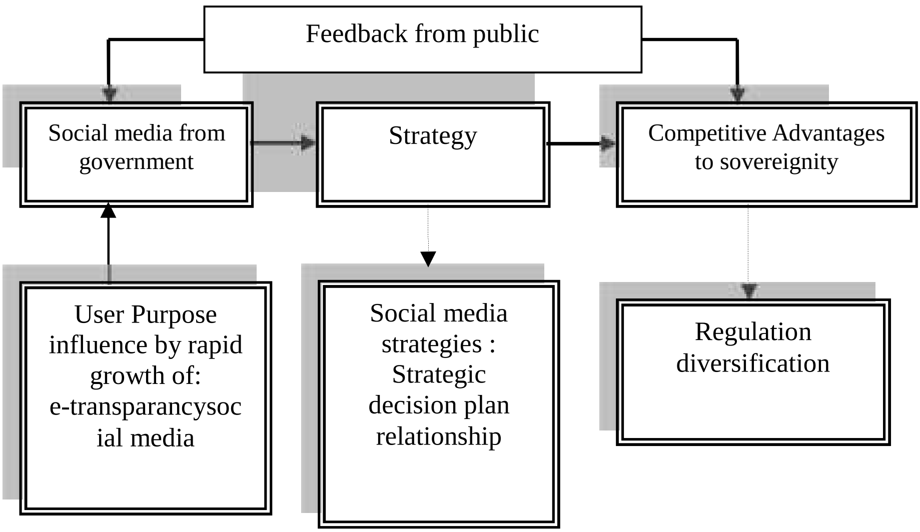

Figure 4. Empiricalimplication from e-government concept from public feedback onregulation

One of the main advantages attributed to the social media is its versatility, and the interviewees were indeed using social media for different purposes, most commonly as a relationship marketing tool. The benefits of social media as a viral or buzz marketing tool were also suggested by the study. Nearly all the interviewees were able to give examples of ways in which their social media had been beneficial to their government regulation in terms of lead generation or networking.

However, value added for each of them was not considered by interviewees to be a deciding factor in whether to attracting social media reader or customer. Most had a belief in the positive impact of having a social media despite the lack of measurable results in terms of increased revenue and more public expectation. The advantage of a social media illustrated by the majority of respondents,this shows that people have different attitudes within the usability of the social media and influenced by factors, and has feedback to improve strategy becoming more effective.

Social media user doing learning merely from observing an action conducted by someone else, or simply from one person to the other. Individuals need to engage in the activity and in a communicative relationship to learn and create social media as a government regulation tool, meaning of all new successfully way of viral marketing. It is not until we bring our ideas to our consciousness that we are able to create new one and decide how we want to use it. Individual reflection is an important marketing strategy to assist in developing the performance insight of the social media government regulation user, and to promote their product and services that are displayed in order to attract more customer with permalinks (permanent link) and RSS feeds technique . In our idea using social media as government regulation tool assistant for small and medium enterprises by engaging those in strategy and by encounter them with a strategic management plan. Social media is to be vital in building relationships between the peer to peer, and the social dialogue that is triggered through posts and comments onsocial media isshowing evidence of deep reflection and creativity. (Kalakota and Robinson, 2001). Every social media user performance not same from one user with others, looking forward, and this supported by social media creating purposes, handle fit strategy. Offering and displaying product and services, with other contact or social media readers provide opportunitiesfor small and medium enterprises and improve the ideas to help build and create new job and new industry.. Social media government regulationisthe best tool to provide the condition that social media users work onother methods, in other way potentially helping family income.

CONCLUSION

Social mediaspreading government regulationoffers a significant potential benefit to learners, by accelerating the learning processes and by providing opportunity forgovernment regulation and actively as trader online and new way of information and regulation. The technical and social networking philosophy of social media s enables them to be used in a number of marketing useful ways, the simple act of posting and displaying product and services to a social media satisfies a number of government regulation or profit result. The technical infrastructure of doing social media government regulation assists marketing sharing and gathering and this help customer to read information and judge about social media government regulation performance, and then this process helps to social media user to create their own strategy and information and regulation.

Using social media intomaking more sophisticated government regulation help social media users do more creative and becoming government regulation actors also helps to develop social media users reflective thinking and it also helps to encounter poverty. We believe social media government regulationis ideal in blended social media and face-to-face learning environments if both social media purposes, strategy adapting by social media users embrace the trading online with curious and explorative enthusiasm. In addition, the social media government regulation user has to enforce enough structure, rules, practice, and prior information to give the social media users an opportunity to familiarize with the new way of government regulation as quickly and effortlessly as possible. Social media s and other social networking technology are enabling us to integrate connecting and networking with people as a natural part of everyday life. The boundary between formal and informal relationship is becoming indication to makea wide variety of social media usability for government regulation. At the end the power of this new communication technology is not the tool itself, but those of us that choose to use it and participate in the wider community of users.

The future of social networkinglike pearl on the mud.Its mean, people thinking spent time while social media is wasting time. A better understanding of popular technologies,is beneficial for both academics and practitioners to better prepare for the future. This simple research believes social networking , such as create government regulationsocial media going, will have a turnaround impact on organization networking based on the analysis of the current situation, new technology opportunity for doinggovernment regulation and encouraging small medium enterprises advantages.

THEORETICAL IMPLICATIONS

This study is the starting point for investigating the fit between social media user purposes and strategy to attract customer needs, becoming value added and practical tools on social media government regulation. As a human being, becoming a network or to be networking increasingly appear to balance the social needs and economy.

Social media user for government regulation requirements for product and services, extending the view of task social media technology fit as a driver of government regulation usage appears to be highly relevant and necessary. After all, if the social media useris encouraged by their contact to making their personal social media government regulation, the separation between purposes and strategy becomes connected to reach added value. The advantage of online shops is that their costs are lower and they are less constrained for space than their physical counterparts (Shim et al, 2000). Yet this era has passed, allowing innovations to be driven by social media user by developing their networking and competitive advantage that leads to a significant restructuring of social mediagovernment regulation and marketing related. However, yet have to develop appropriate theories to understand and explain the new interrelationships between purposes and social media government regulation strategy, as well as the larger issue of “e-government”.

IMPLICATION FOR PRACTICE

The practical impact ofsocial media users that understand social networking should be fast. First, internally, the value proposition of social networking is relationship. While adoption of new technologies traditionally requires the alignment of numerous critical success factors, such as internal and external influences, purposes, competitive advantages or value added in term of e-government environment.

Social media government regulation user in simple way can generate government regulation on simply organizational buy-in, successful government regulationsocial media have proven their value without these, usually based on intrinsic attractiveness, simplicity, and low cost. Hence, their organizational adoption becomes much easier and can take advantage of social media users’ own investment in self-government regulation outside the workplace. Second, social media user or small medium enterprises must understand social networking philosophy as a golden way that draws significant customer attention. Either they need to compete for attention with other competitors or are able to use the strategy as a communications channel to better reach public expectation. At last social media user for government regulation need states their strategic management plan providing a better channel to reach public expectation and that action should be able to reap extraordinary benefits.

FUTURE RESEARCH

In order to study the phenomenon in detail, much work needs to be done, beyond this exploratory study. More users will need to be surveyed so as to obtain more detailed, well-tested findings. Such an inquiry will need to consider the impact of other variables, such as age or gender, factors ignored in this study. Next, conjectures made about the correlation between purposes and strategy within social media government regulation user will need to be tested, for instance through interviews with the customer which spent online buying with social media gurus.

Furthermore, a much needed extension will be a broadening of scope to include at least one more relationship to determine common patterns, social networking, and their potential factors on e-government. In the future, for small and medium enterprises (SME), they can use social media as alternative tools for marketing. Nowadays they are not using it effectively,the result of this research showing with vision state on purposes while they create social media, strategy and value added angle here is clearly a winner. It does not guarantee, however, that people will get it or will choose social media for government regulation because of this angle. As we know, there are many factors that go into a decision to pick one social network over another. Perhaps adding more value and features to the social mediagovernment regulation function would help the government regulation adoption, but the current focus on competitive advantages.

REFERENCES

Anonymous.(2017) *Strategic data*. Indonesian Central Board of Statistics

Bose, R., Sugumaran, V. (2003), " Application of knowledge management technology in customer relationship management", Knowledge and process management journal , Vol. 10 No. 1, pp. 3-17.

Dous, M., Salomann, H., Kolbe, L., & Brenner, W. (2005)," Knowledge Management Capabilities in CRM: Making knowledge For, From and About public expectation work", Proceedings of the Eleventh Americas Conference on Information Systems. August.

Flynn, Nancy. (2006). Social media rules : A government regulation guide to managing policy, public relation and legal issues. Nancy Flynn, New Jersey, USA.

Grant, R. (1996), "Prospering in dynamically competitive environments: Organizations capability as knowledge integration", Organizational Science Journal, Vol. 7-4, pp. 375-387.

Kalakota, R., & Robinson ,M. (2001), E-government 2.0: Roadmap for Success, Addison Wesley

Kalakota, Ravi, & Marcia Robinson (2002), M-Government regulation: The Race to Mobility, McGraw-Hill.

Neuman, W. Lawrence. (1997). Social research methods, Allyn & Bacon 3rd edition. Boston United States of America

Phan, Dien D. (2003), E-Government regulation Development for Competitive Advantages: A Case Study, Information & anagement 40, 581–590.

Porter, Michael E. (2001), Strategy and the Internet, Harvard Government regulation Review, Boston, Mar, Vol. 79, Iss. 3, 63-77

Shim, J.K, Qureshi, A.A, Siegel, J.G, &Siegel, R.M. (2000).The international handbook of electronic commerce, The Glenlake company Ltd

Siebel, Thomas M. (2001), Taking Care of E-Government regulation: How Today's Market Leaders Are Increasing Revenues, roductivity, and Customer Satisfaction, Doubleday.

Teece, D., Pisano, G., & Shuen, A. (1997), "Dynamic Capabilities & Strategic Management", Strategic Management Journal, vol. 18

No. 7, pp. 509-33.

Van de Ven, Andrew, & Engelman, Rhonda M. (2004), *Central problem in managing corporate innovation and entrepreneurship*, in Jerome A Katz & Dean A Shepherd eds.), Corporate Entrepreneurship, 47-65

Weick, K. E. & Quinn, R., (1999), *Organizational change and development*, Annual eview of Psychology, 50: 361-86

Zaichkowsky, Judith Lynne, (1991), *Consumer Behavior: Yesterday, Today, and omorrow,* Government regulation Horizons, Vol. 34 Issue 3, p51, AN 9707080015

Zhao, M., Hoeffler, S., & Zauberman, G., (2007), *Mental Simulation and Preference over ime: The Role of Process- Versus Outcome-Focused Thought,* Journal of Marketing esearch Vol. XLIV pp.379-388, AN 25685161

THE INFLUENCE OF CORPORATE GOVERNANCE TO CORPORATE VALUE WITH EARNINGS MANAGEMENT AS MEDIATING VARIABLE

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ABSTRACT

The purpose of this study was to determine the ability of earnings management to be a mediating variable in the relationship between corporate governance to corporate value of the investor / prospective investors. The sample used in this study was 108 companies that entered the competition Indonesia Most Trusted Company between 2009 and 2014. Path analysis is used by researcher to determine direct and indirect effect between exogenous and endogenous variables in this study. Hypothesis testing is done using SPSS ver. 20. The results obtained in this study is corporate governance has a negative effect on earnings management and earnings management has a negative effect on the enterprise value. Earnings management is capable of being a mediating variable in the relationship between corporate governance with the enterprise value.

Keyword: *corporate governance, earnings management, corporate value, mediation, path analysis*

PENDAHULUAN

Corporate governance telah menjadi topik penelitian yang penting sejak tahun 1960 (Jo dan Harjoto, 2012). *Corporate governance* kembali menjadi pusat perhatian sejak terungkapnya fakta bahwa kegagalan *corporate governance* menjadi salah satu faktor utama terjadinya krisis keuangan di Asia pada tahun 1997 dan krisis pasar modal di U.S. pada tahun 2001 (Mishra dan Bhattacharya, 2011). IMF berpendapat bahwa terjadinya krisis keuangan tahun 1997 di Asia disebabkan oleh lemahnya sistem regulasi dan lemahnya sistem *corporate governance*. Perusahaan tidak memiliki pengendalian keuangan yang mencukupi dan suku bunga pinjaman asing pada saat itu cukup rendah, membuat banyak perusahaan yang tertarik untuk melakukan pinjaman modal dalam valuta asing. Pinjaman modal asing tersebut tidak digunakan secara efisien sehingga tidak dapat memberikan *return* yang diharapkan oleh perusahaan. Ketika nilai tukar valuta asing mengalami penurunan, banyak perusahaan yang tidak mampu untuk melunasi pinjaman modal asingnya sehingga perusahaan-perusahaan tersebut mengalami *financial distress* dan berujung pada kebangkrutan.

Menurut Mishra dan Bhattacharya (2011), krisis pasar modal tahun 2001 di U.S. juga disebabkan oleh buruknya *corporate governance* perusahaan yang terdaftar dalam pasar modal. Sebelum terjadi krisis pasar modal, mayoritas perusahaan di U.S. tidak dikendalikan secara langsung oleh para pemiliknya (*principal*). Untuk meningkatkan kinerja perusahaan, para *principal* memotivasi para *agent* dengan memberikan *bonus scheme* berdasarkan penilaian harga saham perusahaan. Hal tersebut justru membuat para *agent* termotivasi melakukan *earnings management* untuk meningkatkan harga saham, seperti yang terjadi pada Enron dan Lehman Brothers. Terungkapnya kecurangan yang dilakukan oleh perusahaan-perusahaan tersebut beserta Xerox, Healthsouth, WorldCom, dan masih banyak lagi, menyebabkan hilangnya kepercayaan investor terhadap perusahaan. Para investor mulai menarik modal yang mereka investasikan di perusahaan-perusahaan dan menyebabkan terjadinya krisis pasar modal.

Penelitian tentang *corporate governance* di Indonesia masih perlu untuk terus dikembangkan, karena masih sedikit perusahaan di Indonesia yang menerapkan *good corporate governance*. Hal tersebut nampak dari peringkat *corporate governance* Indonesia yang berada paling bawah dibandingkan dengan negara-negara lainnya di ASEAN. Menurut *survey* yang diselenggarakan oleh CLSA *Asia-Pasific Markets* bekerja sama dengan *Asian Corporate Governance Association* (ACGA), Indonesia mendapat peringkat paling bawah selama beberapa tahun hingga tahun 2012 (lampiran 1). Pada *survey* yang diselenggarakan oleh GMI *Ratings*, Indonesia mendapat peringkat 36 dari 38 negara peserta di seluruh dunia (lampiran 2).

Untuk memotivasi para perusahaan agar lebih serius dalam menerapkan *corporate governance*, *Indonesian Institute of Corporate Governance* bekerja sama dengan majalah SWA menyelenggarakan kompetisi untuk memperebutkan penghargaan *Indonesia Most Trusted Company*. Harapan bagi kompetisi tersebut adalah mampu memotivasi para perusahaan agar menerapkan *good corporate governance*, sehingga dapat meningkatkan citra *corporate governance*

Indonesia dalam perspektif dunia internasional.

Penelitian ini ingin mengetahui pengaruh peringkat *corporate governance* terhadap praktek *earnings management* dalam perusahaan yang mengikuti kompetisi *Indonesia Most Trusted Company*. Penelitian ini kemudian mengaitkan peringkat *corporate governance* dengan nilai perusahaan. Nilai perusahaan dipilih dalam penelitian ini karena salah satu tujuan perusahaan adalah memaksimalkan nilai perusahaan. Memaksimalkan nilai perusahaan secara tidak langsung dapat memaksimalkan kesejahteraan pemegang saham (Agustina, 2013). Hal tersebut membuat nilai perusahaan menjadi penting bagi pemegang saham. Semakin tinggi nilai perusahaan maka semakin menarik bagi investor/calon investor. Perusahaan selalu berusaha untuk meningkatkan nilai perusahaan untuk menarik lebih banyak lagi investor untuk menanamkan modal di perusahaan. Manajemen perusahaan selalu berusaha untuk memaksimalkan nilai perusahaan untuk memberikan citra sebagai perusahaan yang dipercaya oleh investor. Salah satu cara untuk melihat nilai perusahaan adalah melalui harga saham. Tingginya harga saham membuat nilai perusahaan menjadi tinggi. Semakin tinggi harga saham menunjukkan bahwa banyak investor yang percaya kepada perusahaan dan membeli saham perusahaan. Oleh karena itu, nilai perusahaan menjadi penting bagi manajemen perusahaan maupun investor/calon investor.

METODOLOGI

Sampel Penelitian

Populasi yang digunakan dalam penelitian ini adalah seluruh perusahaan yang masuk dalam peringkat *The Indonesia Most Trusted Company* yang diterbitkan oleh majalah SWA mulai tahun 2011 hingga tahun 2014. Peringkat *The Indonesia Most Trusted Company* ditetapkan berdasarkan penilaian *Corporate Governance Perception Index* yang dilakukan kepada perusahaan-perusahaan yang mendaftar. Standar penilaian *Corporate Governance Perception Index* dikeluarkan oleh *Indonesian Institute of Corporate Governance*.Pengambilan sampel untuk penelitian ini menggunakan metode *purposive sampling*. Sampel yang digunakan dalam penelitian ini adalah sebanyak 108 perusahaan.

Variabel Penelitian

1) *Corporate Governance*

Definisi *corporate governance* secara umum adalah seperangkat peraturan dalam perusahaan yang mengatur hubungan antara *agency* dan *principal* dengan tujuan untuk meningkatkan operasional perusahaan sehingga dapat memberikan nilai tambah bagi para pemegang saham. Dalam penelitian ini, *corporate governance* merupakan peringkat ketaatan perusahaan-perusahaan dalam menerapkan *corporate governance* yang diukur menggunakan *Corporate Governance Perception Index*. *Corporate Governance Perception Index* dikeluarkan oleh *Indonesian Institute of Corporate Governance* yang bekerja sama dengan majalah SWA. Perusahaan yang memperoleh skor *Corporate Governance Perception Index* sebesar 56 hingga 69,99 maka perusahaan tersebut memiliki predikat cukup terpercaya. Perusahaan yang memperoleh skor sebesar 70 hingga 84,99 maka perusahaan tersebut memiliki predikat terpercaya. Perusahaan yang memperoleh skor sebesar 85 hingga 100 maka perusahaan tersebut memiliki predikat sangat terpercaya.

2) *Earnings Management*

Earnings management adalah tindakan untuk mengelola laba yang dilakukan oleh manajer yang berlaku *opportunist* untuk mencapai tujuan dan kepentingan pribadinya. Variabel *earnings management* dalam penelitian ini diproksikan oleh *discretionary accrual*. Dari lima model yang dijelaskan oleh Dechow dkk. (1995), *The Modified Jones Model* merupakan model yang paling optimal untuk menghitung *discretionary accrual*.

Penghitungan *earnings management* dimulai dari penghitungan total laba akrual perusahaan. Total laba akrual perusahaan berisi *nondiscretionary accrual* dan *discretionary accrual*.

$$TA_t = NI_t - CFO_t \ldots\ldots\ldots\ldots\ldots (1)$$

Nilai total laba akrual dapat dijabarkan melalui persamaan regresi OLS sebagai berikut.

$$TA_t/A_{t-1} = \alpha_1 \left(1/A_{t-1} \right) + \alpha_2 \left(\Delta REV_t/A_{t-1} \right) + \alpha_3 \left(PPE_t/A_{t-1} \right) + e \ldots (2)$$

Persamaan regresi di atas berguna untuk menghitung koefisien α_1, α_2, dan α_3, yang akan digunakan dalam rumus penghitungan *nondiscretionary accrual*.

$$NDA_{\tau} = \alpha_1 \left({}^{1}/_{A_{\tau-1}} \right) + \alpha_2 \left({}^{\Delta REV_{\tau}}/_{A_{\tau-1}} - {}^{\Delta REC_{\tau}}/_{A_{\tau-1}} \right) + \alpha_3 \left({}^{PPE_{\tau}}/_{A_{\tau-1}} \right) + \varepsilon_{\tau} \ldots (3)$$

Setelah nilai *nondiscretionary accrual* telah diketahui, *discretionary accrual* dapat diketahui dengan rumus sebagai berikut.

$$DA_{\tau} = \frac{TA_{\tau}}{A_{\tau-1}} - NDA_{\tau-1} \ldots\ldots\ldots(4)$$

TA_{τ} = *Total accrual*
NI_{τ} = *Net income*
CFO_{τ} = *Cash Flow from Operation*
NDA_{τ} = *Nondiscretionary accrual*
$A_{\tau-1}$ = Total asset pada tahun τ-1
ΔREV_{τ} = Pendapatan tahun τ dikurangi pendapatan tahun τ-1
ΔREC_{τ} = Piutang bersih tahun τ dikurangi hutang bersih tahun τ-1
PPE_{τ} = *Gross Property, Plant, & Equipment* tahun τ
DA_{τ} = *Discretionary accrual*

3) Nilai Perusahaan

Nilai perusahaan merupakan penilaian atau harga yang diberikan para pelaku pasar terhadap kinerja perusahaan secara keseluruhan.Penelitian ini menggunakan rasio Tobin's Q untuk menghitung nilai perusahaan. Rasio Tobin's Q dapat mencerminkan nilai perusahaan, karena memasukkan hutang dan ekuitas perusahaan dalam penghitungannya (Agustina, 2013).

$$Q = \frac{MVE + D}{BVE + D}$$

Jika sebuah perusahaan memiliki rasio Tobin's Q lebih dari 1, keuntungan yang dihasilkan oleh *asset* perusahaan tersebut melebihi nilai investasi yang dikeluarkan untuk memperoleh *asset* tersebut (Agustina, 2013; Amanti dan Venusita, 2012).

Pengolahan Data

Pengolahan data untuk penelitian ini menggunakan model analisis jalur (*path analysis*). *Path analysis* merupakan salah satu model persamaan struktural, yang digunakan untuk menjelaskan pola hubungan serta akibat langsung dan tidak langsung dari variabel-variabel yang terdapat dalam penelitian ini. *Path analysis* merupakan variasi dari analisis regresi berganda yang dapat digunakan untuk mengetahui variabel eksogen yang dominan mempengaruhi variabel endogen.Penelitian ini menggunakan dua model persamaan struktural, yaitu:

a. Pengaruh variabel independen (X) terhadap variabel mediasi (Z)

$$EM = \beta_1 CG + e$$

b. Pengaruh variabel independen (X) dan variabel mediasi (Z) terhadap variabel dependen (Y)

$$NP = \beta_2 C + \beta_3 EM + e$$

HASIL PENELITIAN

Penelitian ini melakukan *path analysis* dengan menggunakan bantuan SPSS versi 20. Model persamaan struktural yang akan dianalisis adalah:

1. $EM = \beta_1 CG + e$
2. $NP = \beta_2 CG + \beta_3 EM + e$

Hubungan Antar Variabel Penelitian

No.	Jalur	Sig.	Pengaruh		
			Langsung	Tidak Langsung	Total
1	CG → NP	0,875 Tidak signifikan	0,016	-	-
2	CG → EM	0,049 Signifikan	-0,203	-	-
3	EM → NP	0,025 Signifikan	-0,214	-	-
4	CG → EM → NP	Signifikan	0,016	-0,203x-0,214 = 0,043	0,059

a. Pengaruh peringkat *corporate governance* terhadap nilai perusahaan dari sisi investor/calon investor

Hasil analisis menggunakan SPSS menunjukkan bahwa peringkat *corporate governance* tidak berpengaruh terhadap penilaian perusahaan dari sisi investor/calon investor. Tingkat signifikansi yang diperoleh adalah 0,875, lebih besar dari tingkat signifikansi 0,1.

Ada beberapa pendapat yang dapat menjelaskan alasan *corporate governance* tidak mempengaruhi nilai perusahaan. Pendapat yang pertama adalah para investor/calon investor tidak mempertimbangkan peringkat *corporate governance* yang diselenggarakan oleh CGPI dan majalah SWA dalam menilai perusahaan (Ratih, 2011). Pendapat yang kedua adalah rasio keuangan dianggap sebagai tolak ukur yang lebih baik daripada *corporate governance* bagi investor/calon investor dalam menilai perusahaan hingga tahun 2015. Peringkat *corporate governance* tidak dapat menjadi jaminan bahwa perusahaan akan mampu membayar dividen kepada para pemegang saham maupun melaksanakan kewajibannya yang lain dengan baik. Hal tersebut yang diduga menjadi penyebab *corporate governance* belum menjadi sesuatu yang penting para investor/calon investor.

b. Pengaruh peringkat *corporate governance* terhadap praktek *earnings management*

Hasil analisis menggunakan SPSS menunjukkan bahwa peringkat *corporate governance* berpengaruh negatif dan signifikan terhadap praktek *earnings management*. Nilai koefisien pengaruh peringkat *corporate governance* terhadap *earnings management* adalah -0,203. Tingkat signifikansi yang diperoleh adalah sebesar 0,049, lebih kecil dari tingkat signifikansi 0,1.

Hasil penelitian ini mendukung hasil penelitian milik Uwuigbe dkk. (2014), Kang dan Kim (2011), dan Tangjitprom (2013). Semakin tinggi skor *corporate governance* yang diperoleh perusahaan peserta *Indonesia Most Trusted Company* menunjukkan bahwa penerapan *corporate governance* perusahaan tersebut semakin baik. Penerapan *corporate governance* yang baik dapat membantu menyelesaikan *agency problem* yang terjadi dalam perusahaan (Kang dan Kim, 2011), sehingga menurunkan peluang terjadinya *earnings management*.

c. Pengaruh praktek *earnings management* terhadap nilai perusahaan dari sisi investor/calon investor

Hasil analisis menggunakan SPSS menunjukkan bahwa praktek *earnings management* berpengaruh negatif terhadap penilaian perusahaan dari sisi investor/calon investor. Nilai koefisien pengaruh *earnings management* terhadap nilai perusahaan adalah -0,214. Tingkat signifikansi yang diperoleh adalah sebesar 0,025, lebih kecil dari tingkat signifikansi 0,1.

Para investor mencari informasi mengenai perusahaan dari berbagai sumber terpercaya mereka, seperti pihak dalam perusahaan dan berbagai media pemberitaan yang lain. Oleh karena itu investor mampu mengetahui laporan keuangan suatu perusahaan yang telah dimanipulasi untuk suatu tujuan tertentu. Jika perusahaan mampu menutupi fakta atau kenyataan dalam laporan keuangannya dari para investor/calon investor ataupun *stakeholders* perusahaan yang lain, besar kemungkinan perusahaan tersebut akan mampu untuk menutupi lebih banyak lagi mengenai kondisi atau kinerja perusahaan. Oleh karena itu para investor cenderung menghindari perusahaan yang melakukan *earnings management* dalam laporan keuangannya. Hal tersebut membuat perusahaan tidak menarik bagi para investor, sehingga mengakibatkan turunnya nilai perusahaan bagi investor.

d. *Earnings management* sebagai mediasi antara hubungan peringkat *corporate governance* dengan nilai perusahaan dari sisi investor/calon investor

Hasil analisis menggunakan SPSS menunjukkan bahwa pengaruh peringkat *corporate governance* terhadap nilai perusahaan dari sisi investor/calon investor dengan dimediasi *earnings management* signifikan. Hal tersebut karena terdapat hubungan yang signifikan antara peringkat *corporate governance* dengan praktek *earnings management*, dan hubungan yang signifikan antara praktek *earnings management* dengan nilai perusahaan dari sisi investor/calon investor. Oleh karena itu praktek *earnings management* mampu menjadi variabel mediasi dalam hubungan antara peringkat *corporate governance* dengan nilai perusahaan.

Koefisien jalur *corporate governance* menuju nilai perusahaan melalui *earnings management* adalah 0,043, diperoleh dari perkalian koefisien jalur *corporate governance* menuju *earnings management* dengan koefisien jalur *earnings management* menuju nilai perusahaan. Koefisien jalur *corporate governance* langsung menuju nilai perusahaan adalah 0,016. Koefisien pengaruh tidak langsung melalui variabel mediasi lebih kuat daripada koefisien pengaruh *corporate governance* langsung menuju nilai perusahaan.

SIMPULAN

Penelitian ini menganalisis *earnings management* sebagai mediasi dalam hubungan antara *corporate governance* terhadap nilai perusahaan dari sisi investor/calon investor. Dari 192 perusahaan yang masuk dalam *Indonesia Most Trusted Company* periode 2009 hingga 2014, peneliti menggunakan 108 perusahaan sebagai sampel dalam penelitian ini. Penelitian ini menggunakan *path analysis* untuk melakukan mengolah data, dengan dibantu program SPSS ver. 20.

Hasil analisis yang diperoleh dalam penelitian ini menunjukkan bahwa terdapat dua dari tiga jalur pengaruh langsung yang terbukti memiliki pengaruh signifikan. Jalur pertama adalah *corporate governance* terbukti memiliki pengaruh secara signifikan terhadap praktek *earnings management* dalam perusahaan. Koefisien yang diperoleh sebesar -0,203 dengan tingkat signifikansi sebesar 0,049. Jalur kedua adalah *earnings management* terbukti memiliki pengaruh secara signifikan terhadap nilai perusahaan dari sisi investor/calon investor. Koefisien yang diperoleh sebesar -0,214 dengan tingkat signifikansi sebesar 0,025. Hubungan antara *corporate governance* terhadap nilai perusahaan terbukti tidak memiliki pengaruh yang signifikan.

Hasil analisis *earnings management* sebagai variabel mediasi menunjukkan bahwa *earnings management* mampu menjadi mediasi dalam hubungan antara *corporate governance* menuju nilai perusahaan dari sisi investor/calon investor. Koefisien jalur pengaruh tidak langsung dengan *earnings management* sebagai mediasi diperoleh sebesar 0,043, lebih besar dari koefisien jalur pengaruh langsung dalam hubungan *corporate governance* terhadap nilai perusahaan sebesar 0,016.

Peneliti menghadapi beberapa keterbatasan selama melakukan penelitian, antara lain:

1. Akses majalah SWA
   Akses majalah SWA menjadi kendala peneliti dalam memperoleh sampel penelitian. Peneliti hanya mampu mengakses majalah SWA mulai tahun 2009 hingga 2014, sehingga sampel penelitian yang diperoleh cukup sedikit.
2. Kurangnya jurnal pendukung
   Selama melakukan penelitian, peneliti merasa bahwa jurnal pendukung yang membahas pengaruh *earnings management* dengan nilai perusahaan masih sedikit.

Berdasarkan keterbatasan tersebut, saran yang dapat diberikan penulis untuk penelitian selanjutnya antara lain:

1. Memperbanyak sampel yang digunakan. Semakin banyak data yang digunakan diharapkan hasil yang diperoleh dalam penelitian akan semakin valid. Jika penelitian selanjutnya memiliki akses majalah SWA dengan jangka waktu lebih panjang, diharapkan dapat menjadi evaluasi dari penelitian ini. Penelitian selanjutnya juga dapat mengganti kriteria perusahaan yang digunakan sebagai sampel penelitian, agar dapat memperoleh jumlah sampel yang cukup banyak.
2. Penelitian yang selanjutnya diharapkan dapat meneliti penyebab atau faktor-faktor internal maupun eksternal perusahaan yang membuat kompetisi *Indonesia Most Trusted Company* tidak mampu memberikan nilai tambah bagi perusahaan. Dikhawatirkan hal tersebut merupakan gambaran dari penilaian para investor terhadap penerapan *corporate governance* perusahaan-perusahaan di Indonesia.
3. Penelitian selanjutnya diharapkan mampu menggali lebih dalam mengenai pengaruh *earnings management* terhadap nilai perusahaan. Hal tersebut untuk memperkaya *literature* terkait *earnings management* dan nilai perusahaan.

DAFTAR PUSTAKA

Agustina, S. 2013. Pengaruh profitabilitas dan pengungkapan corporate social responsibility terhadap nilai perusahaan. *Jurnal Akuntansi, 1*(1).

Amanti, L., dan Venusita, L. 2012. Pengaruh Good Corporate Governance Terhadap Nilai Perusahaan dengan Pengungkapan Corporate Sosial Responsibility sebagai Variabel Pemoderasi (Studi Kasus Pada Perusahaan Rokok Yang Terdaftar Di BEI). *JURNAL AKUNTANSI UNESA, 1*(1).

Dechow, P. M., Sloan, R. G., dan Sweeney, A. P. 1995. Detecting earnings management. *Accounting review*, 193-225.

Jo, H., dan Harjoto, M. A. 2012. The Causal Effect of Corporate Governance on Corporate Social Responsibility. *Journal of business ethics, 106*(1), 53-72. doi: http://dx.doi.org/10.1007/s10551-011-1052-1

Kang, S.-A., dan Kim, Y.-S. 2011. Does Earnings Management Amplify The Association Between Corporate Governance And Firm Performance?: Evidence From Korea. *The International Business & Economics Research Journal, 10*(2), 53-66.

Mishra, A. S., dan Bhattacharya, S. 2011. The Linkage Between Financial Crisis and Corporate Governance: A Literature Review. *IUP Journal of Corporate Governance, 10*(3), 71-84.

Ratih, S. 2011. Pengaruh Good Corporate Governance Terhadap Nilai perusahaan Dengan Kinerja Keuangan Sebagai Variabel Intervening Pada Perusahaan Peraih The Indonesia Most Trusted Company-CG. Skripsi. Fakultas Ekonomi dan Bisnis. Universitas Diponegoro. Semarang. *Jurnal Kewirausahaan, 5*(2), 18-24.

Uwuigbe, U., Peter, D. S., dan Oyeniyi, A. 2014. The effects of corporate governance mechanisms on earnings management of listed firms in Nigeria. *Journal of Accounting and Management Information Systems, 13*(1), 159-174.

THE RATIO OF FLEXURAL STRENGTH BETWEEN CONCRETE FROM LIGHT STEEL REINFORCEMENT AND CONCRETE FROM IRON REINFORCEMENT

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Abstract

Currently, the world of housing construction is developed rapidly through innovation. With the innovation is expected to create an efficient construction products. However, in fact, the current innovation in housing construction in Indonesia is considered immobile. Structures of reinforced concrete are planned on the basis of bending collapse and the blocks are used to withstand bending forces. Lightweight steel on buildings tends to be used only as a roof frame. The phenomenon in the field that lightweight steel roof truss can be united with mortar mix on the construction wall of horses made of red stone. Thus this phenomenon is captured for later applied dynamically, creatively, and innovatively with the new idiom as the beam reinforcement. This research is aimed to find out the ratio of flexural strength between concrete from light steel reinforcement and concrete from reinforcement. Strong Concentric Bounding Test Methods with Simply Challenged Weapons Test Directly used in this study. The bending test equipment used is a compression test machine, the machine shall be equipped with two support beams and one load beam, loaded bok construction and pedestal blocks. Test object in this research amounted to 6 pieces of blocks made of different reinforcing steel. The first test object was three concrete blocks made of 600 mm x 150 mm x 150 mm and reinforcing steel with 6 mm diameter. The second specimen consists of three concrete blocks made of 600 mm x 150 mm x 150 mm sections and mild steel with a profile profile of C73.35.10 mm. The test specimen shall comply with the provisions of SNI 03-2493-1991 on the Preparation and Maintenance of Concrete Test Items in the laboratory. This study concluded that test beams made of 600 mm x 150 mm x 150 mm and light steel with profiles of C73.35.10 mm have twice the maximum flexural strength compared to test beams made of 600 mm x 150 mm x 150 mm cross section and steel reinforcement with a diameter of 6 mm.

Keywords: Strong bending beam, light steel, concrete from reinforcement

INTRODUCTION

Currently, the world of housing construction is developed rapidly through innovation. With the innovation is expected to create an efficient construction products. However, in fact, the current innovation in housing construction in Indonesia is considered immobile. The inefficiency of construction work is caused by non-moving innovations (Manual of the National Steel Truss Innovation Contest "Ritter" 1, 2016). Structures of reinforced concrete are planned on the basis of weak bone structure, meaning as follows: First, the collapse of structures occurs due to the flexural collapse; Second, high compressive strength is owned by high strength concrete and tensile strength of steel reinforcement material (Widyawati, 2009); Third, the beams functioned to withstand the bending forces caused by the load acting on the floor and the loads distributed to the supporting columns (Helmi, 2009).

Structures of reinforced concrete are planned based on weak repeating structures (flexible collapse) (Widyawati, 2009). Strong bending is the tensile strength of indirect concrete caused by concrete moment. The maximum bending strength occurs on the bottom fiber of the concrete beam. There are three flexible collapses on reinforced concrete structures that may occur such as pull collapse, collapse, and press collapse (Cahyono, 2015). The beams functioned to resist the flexural forces caused by the loads acting on the floor and the loads would be distributed to the support columns. The bending strength of the beam can be obtained from the bending test of the beam which is given two centralized loads with ½ P at the point of 1/3 of the span of the pedestal (shown in Figure 1) (Helmi, 2009).

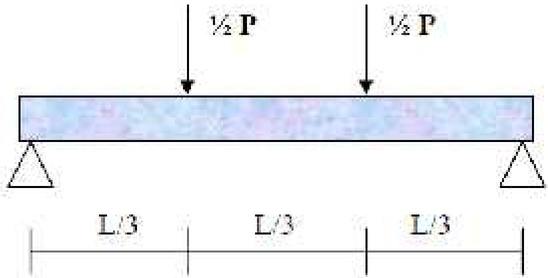

Figure 1. Bending tests with 2 centralized loads (Helmi, 2009)

Reinforcing steel is the main material composed by reinforced concrete, especially when there is bending on reinforced concrete. The amount of bending strength in reinforced concrete is closely related to the condition of reinforcing steel (Cahyono, 2015). The crack conditions are caused by three voltages, as follows: Condition 1 is flexural cracks; Condition 2 is flexural-shear cracks; and Condition 3 is the diagonal tension cracks (Dewi, et al., 2012). Bending capacity is owned by square columns with better circular and circular ductility. The pattern of bending cracks occurs in all patterns of column cracking (Busthamy, 2014). Thus it can be concluded that the pattern of cracks that occur in all columns is the pattern of flexible cracks.

According Lisantono, et al., (2013) that the current usage of channel profile C is not limited only for gording but also used as home structural elements such as columns. This is in line with the statement of Jiwandono (2010) and Laksono (2009) that the channel profile C when used as a column and given a casting concrete cast, proved to prevent local buckling. To increase profile stability, reinforcement is used with reinforcing steel and add cast filler concrete within its profile. In the Wigroho (2008) study on the C profile filled by concrete against the crack pattern it is stated that it can prevent shear failure in the concrete. This is reinforced by Lisantono and Sari (2009) research suggesting that the C canal profile beam filled with lightweight concrete improves the bending strength compared to the C canal profile beam without lightweight concrete filler. In the research Lisantono and Jiwandono (2011) stated that the channel profile C has a weakness in terms of stability. Therefore, in the application the profile needs to be given a stiffener and must be double installed. Thus it can be concluded that dual C channels filled with concrete cast can prevent local buckling, increase load capacity, increase column strength, increase profile stability, and increase bending strength. Wood materials in a housing construction can be replaced with a lightweight steel frame. However, lightweight steel in buildings tends to be used only as a roof frame. The phenomenon in the field that lightweight steel roof truss can be united with mortar mix on the construction wall of horses made of red stone. Thus this phenomenon is captured for later applied dynamically, creatively, and innovatively with the new idiom as the beam reinforcement. This research is aimed to find out the ratio of flexural strength between concrete from light steel reinforcement and concrete from reinforcement.

METHODOLOGY

Types of Research Methods

Strong Concentric Bounding Test Methods with Simply Challenged Weapons Test Directly used in this study. This method is intended as a reference and a handle in conducting laboratory bending tests. This research will be conducted on Saturday, August 19, 2017 at the Laboratory of Materials Testing and Construction, Department of Civil Engineering, Faculty of Engineering, University of Halu Oleo. The bending test equipment used is a compressive test machine, the machine shall be equipped with two support beams and one load beam, load bok construction and pedestal blocks, and measuring devices such as gauge length, wheel length, treadmill, scales, stationery, and test result form. Test object in this research amounted to 6 pieces of column made of different reinforcement steel. Three columns are made of lightweight steel reinforcement material and three other columns are made of reinforced steel material. The test shall comply with the provisions of SNI 03-2493-1991 on the Preparation and Maintenance of Concrete Test Items in the applicable laboratory. The sizes of the blocks are 600 mm in length, 150 mm in width, and 150 mm in length. All surface planes shall be flat and free load from scratch defects, holes and indentations. The side planes should be perpendicular to the upper and lower fields. The bending strength is calculated using the equation.

$$f_{lt} = \frac{3PL}{2bd^2} \quad \text{.......................................} \quad (1)$$

Information:

f_{lt} = Strong bending, in Mpa

P = The maximum load resulting in collapse of the test beam, in Newton

L = The length of the span between the two support beams, in mm

b = The average beam width at the cross section collapses, in mm

d = The height of the mean beam on the cross section of the cross-section collapses, in mm

RESULT

Flexible Strength Testing

This test is carried out using the Central Bundled Test Block directly and at the time of the test object is 28 days old. The load at the time of the first cracked column when receiving the load (Pmax) is obtained by direct central bending strength testing. From the load data obtained obtained the maximum compressive strength of the compressive loading power. The number of specimens used for each reinforcement variation in the bending strength test is 6 pieces. The results of robust strength testing are presented in table (1) and table2 as follows:

Table 1. Condition of the test object

Test specimen column						
No.	Code	Date	Total Length (mm)	Cross Section Wide (mm)	Cross Section High (mm)	Weight (kg)
1.	KBT1	30/07/2017	600	150,00	150,00	32,70
2.	KBT2	30/07/2017	600	150,00	150,00	32,50
3.	KBT3	30/07/2017	600	150,00	150,00	31,00
4.	KBR1	30/07/2017	600	150,00	150,00	31,75
5.	KBR2	30/07/2017	600	150,00	150,00	33,00
6.	KBR3	30/07/2017	600	150,00	150,00	32,60

Table 2. Strength bending test results of column material of reinforcing steel and column material of mild steel

Test specimen column							
No.	Code	b.j. (kg/m3)	Date	Age (hr)	Powerful Max (kN)	Strenght Bending (Mpa)	Strenght Bending Average (Mpa)
1.	KBT1	2,422	19/08/2017	28	17,50	3,889	3,889
2.	KBT2	2,407	19/08/2017	28	20,00	4,444	
3.	KBT3	2,296	19/08/2017	28	15,00	3,333	
4.	KBR1	2,352	19/08/2017	28	30,00	6,667	6,296
5.	KBR2	2,444	19/08/2017	28	25,00	5,556	
6.	KBR3	2,415	19/08/2017	28	30,00	6,667	

Table (1) explains that the condition of the specimen before it is tested is supple. Table (2) above explains that the maximum bending strength of the beam test with a cross section of 600 mm x 150 mm x 150 mm and steel reinforcement with a diameter of 6 mm is 3.889 MPa average. Beam test result made of cross section 600 mm x 150 mm x 150 mm and mild steel with profile shape C73.35.10 mm got average 6,296 Mpa.

CONCLUSION

Based on the above research it is found that the test beam made of cross section 600 mm x 150 mm x 150 mm and mild steel with the profile shape C73.35.10 mm has twice maximum flexural strength than test beam made from cross section 600 mm x 150 mm x 150 mm and reinforcing steel with a diameter of 6 mm. Thus, concrete blocks made of lightweight steel reinforcement can be recommended in public housing. This research can be continued to test the concrete columns of mild steel with the profile form C73.35.10 mm against maximum bending strength.

REFERENCES

Buku Manual National Steel Truss Innovation Contest “Ritter” 1, 2016, *National Steel Truss Innovation Contest*, Teknik Sipil, Fakultas Teknik, Universitas Tadulako.

Busthamy, I., 2014, *Pengujian Serta Analisis Berbagai Bentuk Kolom Beton Bertulang Terhadap Kapasitas Lentur dan Daktalitas Menahan Beban Lateral,* Undergraduate Thesis, Program Studi Teknik Sipil, Jurusan Teknik Sipil, Fakultas Teknik, Universitas Jember.

Cahyono, T., A., 2015, Analisa *Pengujian dan Perbandingan Kuat Lentur Balok Beton Bertulang Dengan Baja Tulangan Baru dan Baja Tulangan Bekas bongkaran,* Undergraduate Thesis,

Dewi, I., C., Dewi, S.,M., dan Soehardjono, A., 2012, *Sloof Pracetak dari Bambu Komposit*, Jurnal Rekayasa Sipil, Vol 6 No 1.

Helmi, M., 2009, *Perbaikan Balok Beton Bertulang yang Telah Mengalami Beban Puncak Dengan Baja Siku*, Jurnal Rekayasa, Vol 13 No 1, April.

Irianto. 2013. *Komparasi Penggunaan Kayu dan Baja Ringan Sebagai Konstruksi Rangka Atap.* Jurnal Ilmu Pengetahuan dan Teknologi.

Jiwandono, D., P., P., 2010, *Kolom Kanal C Ganda Berpengisi Beton Ringan dengan beban Konsentrik.*

Laksono, D., B., 2009, *Studi Kekuatan Kolom Profil C Dengan Cor Beton Pengisi dan Perkuatan Transversal*, Undergraduate Thesis, Program Studi Teknik Sipil, Fakultas Teknik, Universitas Atma Jaya Yogyakarta.

Lisantono, A., Santoso, B., H., dan Sugianto, R., 2013, *Kolom Kanal C Ganda Berpengisi Beton Ringan Dengan Beban Eksentrik (170S)*, in Konferensi Nasional Teknik Sipil 7 (KoNTekS 7), Universitas Sebelas Maret (UNS) - Surakarta, 24-26 Oktober.

Lisantono, A., dan Sari, M., R., 2009, *Kuat Lentur Profil Lipped Channel Berpengaku dengan Pengisi Beton ringan Beragregat Kasar Autoclaved Aerated Concrete Hebel*, in Konferensi Nasional Teknik Sipil 3 (KoNTekS 3), Jakarta, 6-7 Mei.

Lisantono, A., dan Jiwandono, P., P., 2011, Kolom *Profil "Lipped Cahnnel" Berpengisi Beton Ringan dengan Beban Konsentrik,* in Seminar Nasional-1 BMPTTSSI - KoNTekS 5, Universitas Sumatera Utara, Medan - 14 Oktober.

Nisa, I., J., Mustikawati, T., dan Yatnawijaya, B., 2014, *Ekplorasi Susunan Bata sebagai Bidang Pembentuk Ruang,* Student Journal Architecture, Jurusan Arsitektur, Fakultas Teknik, Universitas Brawijaya.

Rahayu, S., A., 2015, *Analisis Perbandingan Rangka Atap Baja Ringan Dengan Rangka Atap Kayu Terhadap Mutu, Biaya, Dan Waktu,* Jurnal Fropil, Vol 3, Nomor 2, Juli-Desember.

Wildensyah, I. 2010, *Rangka Atap Baja Ringan,* Cetakan kesatu, Alfabeta: Bandung.

Widyawati, R., 2009, *Keruntuhan Lentur Balok pada Struktur Joint Balok-Kolom Beton Bertulang Eksterior Akibat Beban Siklik,* Jurnal Rekayasa, Vol 13 No 3, Desember.

Wigroho, H., Y., 2008, *Kuat Lentur Profil C Tunggal Dengan Perkuatan Tulangan Vertikal dan Cor Beton Pengisi,* Jurnal Teknik Sipil, Vol 8 No 3, Juni : 264 – 277.

EVALUATION OF EFFECTIVENESS AND EFFECTS OF ACTUAL SPEED OF MILLING MACHINE ON PRODUCED CASSAVA PULPS

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Abstract

The results of the calculation of the effectiveness of cassava milling machine for 6 months showed that the values of machine availability, performance and quality yield reached 94.91%, 57.47% and 100% respectively. Based on the results of the above three indicators, the Overall Equipment Effectiveness (OEE) score was 54.55%. This result showed the effectiveness of the machine was still below the saichi nakajima standard, and the main problem was its poor performance. The result of the equation using linear regression analysis to see the effects of the actual speed time (actual cycle time of machine operation) with cassava pulps produced. The result of equation of regression analysis above is **Cassava Pulp = 1654 - 83250 of Actual Speed of Machine**. Based on the hypothesis test, there is a correlation between the pulp variable and the actual speed rate of the milling machine. The result of the deterministic test (R^2) on both variables using Minitab is 55.7%. This determination value indicated that the cassava pulp variable and the actual operating speed of the milling machine have an unfavorable correlation.

Keywords: *Availability, Performance, Quality yield, OEE, and Regression*

INTRODUCTION

The development of Small and Medium Scaled Entreprises (SME) can provide the potential for increased income for the state and business actors involved in these industries. Optimal production planning can affect the efficiency of machine used to produce SMI products. The use of machinery in production must be well managed by every SME entrepreneur so that the number of defective items at the time of production can be eliminated.

The optimal amount of production can be achieved when the time of machine effectiveness and raw material availability can be managed well by the entrepreneurs of SME The method of Overall Equipment Effectiveness (OEE) is one method to assess the effectiveness of the machine in the production. Indicators in the OEE calculation included the availability of working machine time (Availability), the speed of the machine in producing a product (Performance) and quality of the produced product (Quality yield).

Processing of cassava into tapioca flour will produce yield and pulps of cassava. The speed of the milling machine and the quality of raw materials are the factors to be considered in order to improve yields. Cassava pulp is a waste product that will reduce the value of cassava yield. Looking at some of the problems above, the researcher conducted the performance assessment and observed the effects of actual speed of milling machine (machine operation cycle time) on cassava pulps produced in the small and medium scaled industries (SMI).

METHODOLOGY

Design, Time and Location

The study design in this study was a case study using inference statistics where the researcher observed the correlation between the variables of the actual speed/velocity of the engine and the produced cassava pulps. The whole analysis and calculations were adjusted to various real conditions in the field. Data collection on standard time was carried out directly at the SME. The study was conducted for 6 months from July 2016 to December 2016 consisting of preliminary research activities to find out the state of Small and Medium Scaled Entreprises (SME) tapioca flour production directly in the field.

Method of SME Sample Determination

The samples from the SME located at South Sentul of Bogor Regency engaged in cassava flour production. The number of SME samples was determined according to the types of production i.e. make to stock, and only 1 make to stock SME producing tapioca starch regularly was chosen as the samples.

Research Tools

The tools used in this research included Minitab 14 and Microsoft Office Excel to process the data. The data used were static data which include data on actual production quantity, ideal production quantity, and amount of cassava products produced, amount of Rejected Products, machine operation time, set up or adjustment time and machine downtime.

Types and Data Sources

The data used in this study consisted of primary data and secondary data. The primary data were taken directly through the actual observations on the machine in operation while the secondary data used were related to data of amount of production, Product rejects, Set up and adjustment, Downtime machine and Time cycle of the operating machine.

Data and Information Collection Techniques

The data collected were obtained from the internal and external sources. Internally sourced data were obtained through direct observations (on the spot) and interviews with the SME entrepreneurs processing cassava into tapioca flour. The data derived from external source were obtained through literature studies, printed media, internet media, as well as reports issued by the related institutions such as the Central Bureau of Statistics.

RESULT

Overall Equipment Effectiveness (OEE)

The calculations of machine effectiveness were conducted for 6 months from July to December 2016. Based on the OEE calculation results for 6 months, it was found that the problem is in the performance component. The OEE calculation results for 6 months can be seen in Table 1.

Table 1 Calculations of OEE for 6 months

Description	**Result**
1. *Availability*	94.91%
2. *Performance*	57.47%
a. Actual Cycle Time	0.0059 hour/kg
b. Ideal Cycle Time	0.0033 hour/kg
c. LKO	56.31%
d. LOB	102.06%
3. *Quality Yield*	100.00%
4. OEE	54.55%

Based on the OEE calculation results for 6 months, a value of 54.55% was obtained; however, this value of OEE is still below the standard of saichi nakajima that is > 85%. This condition is caused by the poor performance of the machine. Decrease in the value of performance can be caused by material loss i.e. the availability of good quality cassava raw materials to produce flour. It is necessary to analyze the actual speed of the milling machine in producing milled cassava.

The availability of cassava raw materials is influenced by the presence of middlemen who manage the supply of cassava to each SME. If the entrepreneurs of SME wish to obtain cassava raw materials with the quality and quantity they require, there should be a regulation from the government that arrange the suppliers so that the middleman can no longer play roles on prices, quantities and qualities of the raw materials.

The second factor that causes the performance value below the standard of saichi nakajima is the actual speed of the machine in producing 1 kg of milled cassava. The actual speed of the milling machine is 0.0059 hour/kg is still below the ideal speed of 0.0033 hour/kg. This is caused by the condition of the milling machine that has never been well maintained unless the machine is damaged (breakdown maintenance). Further analysis is needed to see the effects of the actual speed of the milling machine on the produced pulps using the linear regression analysis.

Regression Analysis

The average value of cassava yields (yield) is 28% from the raw material of milled cassava. This condition causes problems for small industry entrepreneurs because the yield of cassava pulp produced is huge that is 72%. In the milling process, the main factor observed by SME entrepreneurs is the actual operating speed of the milling machine. When the engine speed is faster, it is estimated that the cassava pulp will be less and the yield will increase. An analysis is required to see if the hypothesis is acceptable.

The variable observed in this regression analysis is the amount of cassava pulp with the actual speed of the cassava milling machine. The data were obtained from the 6-month observations starting from July 2016 to December 2016. The relationship between the two variables is shown by the line equation. The result of equation of regression analysis above is **Cassava Pulp = 1654 - 83250 of Actual Speed of Machine.**

To show whether the two variables were correlated, the test on the hypothesis of the two variables was conducted. This hypothetical test was to see whether the cassava pulp variable produced had a correlation with the actual speed of the milling machine. The results of the test are as follows:

1. $H_0 : \beta_1=0$ (There is no correlation between the amount of pulp produced with the speed of the milling machine)
2. $H_1 : \beta_1 \neq 0$ (There is a correlation between the amount of pulp produced with the speed of the milling machine)
3. α : 0.05
4. The critical Area
   $F_{(0, 05, 1, 48)} = 4.04$
   $F_{table} = 4.04$
5. The test statistic
   Table of Anova

Source	**DB**	**JK**	**KT**	$\mathbf{F_{hit}}$
Regression	1	770320	770320	60.38
Error	48	612426	12759	
Total	49	1382746		

   From the table above, the value of $F_{hit} = 60.38$ was obtained
6. Conclusion
   Because $F_{hit\ is}$ > than $F_{table,}$ H_0 was rejected and H_1 was accepted, indicating that there is a relationship between the pulp variable pulp and the actual speed of the milling machine variable.

From the hypothesis test result, it is found that there is a correlation between the two variables above. A deterministic test is required to see whether the correlation between the two variables is feasible or not feasible. The result of deterministic test (R^2) on both variables using Minitab is 55.7%. The value of the deterministic test shows the score below 80%, so it can be concluded that these two variables have an unfavorable correlation. These results indicate there is another factor besides the actual operating speed of the milling machine which has an effect on the increasing amount of cassava pulps.

CONCLUSION

Based on the results of observations and data processing for 6 months, the calculation results of machine effectiveness and regression relationship analysis were obtained. Based on the calculation results, it can be concluded that:

A. Conclusion

1. Based on the observation data for 6 months, the values of availability of machine of 94.91%, performance of 57.47% and quality yield of 100% were obtained.
2. Based on the calculation method of machine effectiveness, the OEE value of 54.55% was obtained, and this is due to the availability of raw materials whose quality did not comply with production targets.
3. The result of determination test (R^2) produced a value of 55.7%; therefore, the correlation between the amount of cassava pulp produced and the actual machine operating speed is not feasible.

B. Recommendation

1. The scheduling of planned milling machine maintenance is necessary so that engine breakdown is reduced and machine can work optimally.

2. The government support in maintaining the supply of raw materials of cassava to the entrepreneurs of SME is required so that they can obtain good quality raw materials and do not depend themselves on the middlemen.
3. It is necessary to analyze the quality of raw materials of cassava so that the yields of cassava can increase.

REFERENCES

Borris S. 2006. *Total Productive Maintenance*. USA (US) Mc Graw-Hill Companies.

Heizer and Render B. 2011. *Production Operation Management*. 9th Edition. Sungkono, Chriswan, Penerjemah. Jakarta (ID) : Salemba Four. Translated from: *Operation Management*.

Herjanto, E. 2004. *Operation Management.* 3th Edition. Jakarta (ID): PT Gramedia Widiasarana.

Kusuma H. 2004. Production Management, Production Planning and Controlling. *3rd Edition*. Yogyakarta (ID): Penerbit Andi.

Trihendradi, C. 2005. *Minitab 14*: *Step By Step Analysis, Data Statistics.* Yogyakarta (ID):Andi Offset.

Walpole, Ronald E. 1995. *Introduction to Statistics 3rd Edition* Jakarta (ID): PT Gramedia Pustaka Utama

PERFORMANCE TEST OF BIOMASSA STOVE ON VARIOUS AIR FLOWS AND TYPES OF BIOMASSA PELET AS ALTERNATIVE ENERGY RESOURCES

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Abstract

Indonesia's energy needs dominated by industry and household sector will continue to increase nationally in line with Indonesia's population growth. The national energy source still relies on fossil energy of 96%. Utilization of biomass into biomass pellets is one effort to meet energy needs efficiently and reduce imports. Various types of biomass pellets can be used on biomassstove to obtain optimum stove performance. This research aims to determine the potential of various types of biomass pellets as fuel, effect of the performance ofbiomass stoves with variation types of biomass pellets and air flow rate. The study was conducted on a laboratory scale with variations of biomass pellets: rice husk pellets, paper money wastepellets, sugarcane leaves pellets, and sengon wood pellets whichtested by proximate analysis with moisturecontent analysis, ash content, volatile matter, fixed carbon,and calorific value. The four types of biomass pellets were tested on abiomass stove with variations of air velocity of 519 ft/min, 663 ft/min, 778 ft/min, and convection natural with 10 cm diameter. The methode used is water boiling testto calculated thermal efficiency of the stove (ηT),boiling time (t), specific fuel consumption (Sc) and CO emission. The results showed that the pellet biomass has a potential heat energy with the calorific value of sengon wood pellets4093,73 cal/g,sugarcane leaves pellets 3788,87 cal/g,paper money waste pellets 3643,37 cal/g, rice husk pellets 3404,97 cal/g. Optimization of biomass stove performance on rice husk pellet type with air speed 778 ft / min with boiling time average of water 7 minutes, specific fuel consumption (Sc) 1,05 kgs/hr, CO emission 22,69 ppm and stove thermal efficiency value (ηT) 23,32%.

Keywords: Biomass Pellet, Proximate Analysis, Biomass Stove, Water Boiling

INTRODUCTION

Indonesia's energy needs dominated by industry and household sectors will continue to increase nationally in line with Indonesia's population growthof 305.652 million people on 2030 (BPS, 2013). Nowadays, the national energy source of 96% is still dependent on fossil energy. Indonesia should look for alternative, new and renewable energy potentials to meet domestic energy needs, especially in the use of the household sector. One of the potential renewable energy sources in Indonesia is biomass.

Utilization of biomass into biomass pellets is one effort to meet energy needs efficiently and reduce imports. In the household sector, the use of biomass pellets can reduce fossil energy dependence for subsidized LPG users by using biomass stoves. A good biomass stove has a high efficiency and efficient use of biomass fuel from the risk of exposure to smoke, particles and CO gas emissions for traditional firewood users. Various types of biomass pellets can be used on biomass stoves to obtain optimum biomass stove performance.

METHODOLOGY

Each type of biomass pellet was tested for proximate analysis; ash content, moisture content, fixed carbon content, volatile matter content, and calorific value. Then, the biomass pellets (mass: 600 g) were inserted into the burning sleeve in the biomass stove that had been set on the water boiling test position. By adding a little spritus, the biomass pellets are burned and the blower is turned on at a speed of 519 ft / min. After the flame burns, a pot containing 1000 g of water is placed on the stove, then the stopwatch & CO Meter is turned on.

Recording of data is done every minute; temperature (T) of water, temperature (T) of furnace, CO (ppm) level to boiling water. After the fuel runs out and the water temperature drops to 80°C, the observation time is stopped and record the final water mass (g), the residual fuel mass (g), the operating time (t). Testing is repeated with variations of biomass pellets & air velocity.

As Independent Variable are Type of Biomass Pellet : rice husk pellets, waste paper money pellets, sugarcane pellets, sengon wood pellets and Air Flow Rate: 519 ft / min, 663 ft / min, 778 ft / min, natural convection with diameter (d) airflow 10 cm. As Fixed Variable are Biomass Stove with fixed design, Mass of biomass pellets 600 grams, and Mass of water heated : 1000 grams. Then, as Dependent Parameter : Testing of Pellets (ash content (%), moisture content (%), bound carbon content (%), volatile matter (%), and calorific value (cal / g)) and Testing of Stove : Water temperature at any time (^{o}C), Furnace temperature at any time (^{o}C), CO concentration (ppm), final mass of pellet (gram), final mass of water (gram), operating time (min). Tools to be used in this research include ;Thermocouple, Digital Scale, CO Meter, Anemometer , Pan, Stopwatchand Biomass Stove (Modified)

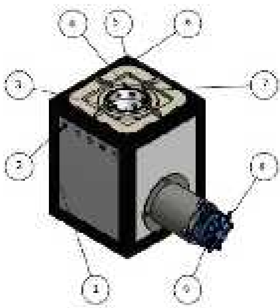

Figure 1 Modified Biomass Stoves & Parts

Caption :
1. Framework
2. Kalsiboard cover 3. Deep shell
4. Outside sleeve
5. Stove mat
6. Kalsiboard cover 2
7. Sleeve support
8. Fan With Battery
9. Kalsiboard Blower

And materials to be used in this research include:

1. Biomass pellet with type of rice husk pellet, paper waste pellet, sugarcane pellets, sengon wood pellets
2. Matches
3. Spritus
4. Water

RESULT

Potential of Biomass Pellets as alternative and renewable energy show on table 1.

Table 1 Proximate Test Results of various types of biomass pellets

No.	Raw Material	Ash Content (%)	Water Content (%)	Volatil Matter (%)	Fixed Carbon (%)	Calorific Value (cal/g)
1	Rice Husk Pellet	15,40	8,67	54,74	21,19	3.404,97
2	Paper Money Waste Pellets	5,01	9,77	68,13	17,09	3.643,37
3	Sugarcane leaves pellets	9,67	11,41	57,71	21,30	3.788,87
4	Sengon Woods pellets	3,24	8,42	65,00	23,35	4.093,73
5	Coal*	11,48	4,02	46,97	37,51	5.994,69

*(Persada, 2017)

Biomass pellets have potential as alternative fuels when compared to coal calorific value of 5994.69 cal/g. The calorific value of biomass pellet as follows; sengon wood pellet 4093,73 cal/g,sugarcane leaves pellet 3788,87 cal/g,waste paper money pellet 3643,37 cal/g and rice husk pellet: 3404,97 cal/g.

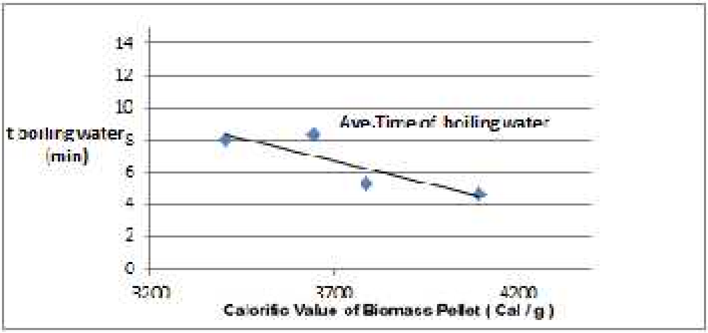

Figure 2 Graph of average calorific value (Q) relationship and time (t) of boiling water under operating conditions using blower

On a biomass stove using an average blower the speed of boiling water is approximately directly proportional to the average heating value contained in the biomass pellet. Thus, the type of biomass pellets that have a higher calorific value will reach the boiling point of water faster.The thermal efficiency of biomass stove in different types of pellets, as follows:

Table 2 Thermal Efficiency of Biomass Stoves in different types of pellets

No	Type of biomass pellets	Calorific Value	Operation Condition	Thermal Efficiency (%)	Average of Thermal Efficiency (%)
1	Rice Husk Pellet	3.404,97	Lv 0	20,56	22,00
			Lv 1	21,97	
			Lv 2	22,13	
			Lv 3	23,32	
2	Paper Money Waste Pellet	3.643,37	Lv 0	22,96	21,58
			Lv 1	19,53	
			Lv 2	21,13	
			Lv 3	22,68	
3	Sugar cane leaves pellets	3.788,87	Lv 0	20,36	21,51
			Lv 1	21,14	
			Lv 2	21,79	
			Lv 3	22,76	

No	Type of biomass pellets	Calorific Value	Operation Condition	Thermal Efficiency (%)	Average of Thermal Efficiency (%)
4	Sengon Woods pellets	4.093,73	Lv 0	20,76	22,01
			Lv 1	21,58	
			Lv 2	22,13	
			Lv 3	23,57	

The average value of thermal efficiency of the stove is between 19% and 24%. Differences in the calorific value of biomass pellets used do not provide significant differences to the efficiency of the stove. This is due to the calculation basis of the calorific value of the biomass pellet itself.

Table 3 Thermal Efficiency of Biomass Stoves on various operating conditions

No	Operation Condition	Type of Biomass Pellets	Stove Thermal Effiicency (%)	Ave. of Thermal Effiicency (%)	Ave. of Sc (kg/h)
1	Lv 0	SP	20,56	21,16	0,65
		UK	22,96		
		DT	20,36		
		KS	20,76		
2	Lv 1	SP	21,97	21,06	0,94
		UK	19,53		
		DT	21,14		
		KS	21,58		
3	Lv 2	SP	22,13	21,80	1,07
		UK	21,13		
		DT	21,79		
		KS	22,13		
4	Lv 3	SP	23,32	23,08	1,11
		UK	22,68		
		DT	22,76		
		KS	23,57		

Note : SP = Rice Husk Pellet ; UK ; Paper Money Waste Pellet ; DT = Sugarcane leaves pellet ; KS = Sengon Wood Pellet

On blower set operation conditions, the highest thermal efficiency value with pellet wood pellets and blower speed is 778 ft / min ie; 23.57%. However, the Sc scores do not meet the SNI standard, so the optimum operating conditions is to use raw material of rice husk pellet and blower with air speed 519 ft / min which is 23,32% and Sc value 1,05 kg / hour. The value of CO is one of the measured values and has limits to provide the security of user. The average value of the smallest and safest CO emissions is 16.15 ppm in the highest use of pellets wood pellets and at the highest risk of using paper money waste pellets, which is 72.97 ppm.

Table 4. Average value of CO emissions by type of biomass pellets

No.	Type of biomass pellets	Operation Condition	Ave.of CO Emission	Ave. (ppm)
1	Rice Husk Pellet	Lv 0	34,80	27,00
		Lv 1	26,31	
		Lv 2	24,22	
		Lv 3	22,69	
2	Paper Money Waste Pellet	Lv 0	57,37	72,97
		Lv 1	81,68	
		Lv 2	76,92	
		Lv 3	75,91	
3	Sugar cane leaves pellets	Lv 0	31,78	34,62
		Lv 1	33,18	
		Lv 2	39,53	
		Lv 3	33,97	
4	Sengon Woods pellets	Lv 0	31,00	16,15
		Lv 1	8,74	
		Lv 2	14,00	
		Lv 3	10,85	

This is related to the results of the proximate analysis in Table 4. where the waste of paper money with the calorific value of 3,643.37 kal / g but has a fixed carbon value of only 17.09%, much different from value of fixed carbon on rice husk pellets 21.19% with a heating value of 3,404.97 cal / g. While the trend of data shows the higher the value of fixed carbon give higher calorific value, for example pellet wood pellets with the calorific value of 4093,73 cal / g has fixed carbon content 23.35%

DISCUSSION

Biomass pellets have potential as alternative fuels when compared to coal , but still need another form to find the best calorific value from biomass. Utilization biomass to pellet biomass and biomass stove have a good potential for Indonesian Industry.

The type of biomass pellet that have a higher calorific value will reach the boiling point of water faster, but didn't giving significant differences to the efficiency of the stove, so need various designs of biomass stove for more higher efficient value. For optimized air flow need further study or analysis such as ultimate analysis to know the biomass content used as raw material of pellet for better calorific value, calculate air ratio and lower CO emission. Use dimmer on blower air supply can adjust the air flow rate. So, it is more optimal in achieving the best conditions with minimal CO emissions and give small Sc value (range 0.5 - 1 kg / hr).

CONCLUSION

Biomass pellets have potential as alternative fuels when compared to coal calorific value of 5994.69 cal/g. The calorific value of biomass pellet as follows; sengon wood pellet4093,73 cal/g,sugarcane leaves pellet 3788,87 cal/g,waste paper money pellet 3643,37 cal/g and rice husk pellet: 3404,97 cal/g.

Optimization of modified biomass stove performance with variation of pellet biomass type gave the best result on the use of sengon wood pellet : mean value of thermal stove efficiency (ɳT) 22.01%, time (t) boiling water average 4.67 minutes on use blower, specific fuel consumption (Sc) 1.01 kg / hour, and CO emission value of 16.15 ppm.

Optimization of modified biomass stove performance with variation of air flow rate at air flow rate 778 ft / min, giving average value of thermal efficiency of stove (ƞT) 23,08%, time (t) boiling water average 5,75 minutes, consumption specific fuel (Sc) 1.11 kg/hr and CO emission value of 35.86 ppm.

Optimization of modified biomass stove performance with variation of pellet biomass type and air flow rate give optimum result on rice husk pellet type with air speed 778 ft / min, ie: time (t) boiling average water 7 minutes, specific fuel consumption (Sc) 1.05 kg / hr, CO 22.69 ppm emission value, and thermal efficiency value of stove (ƞT) 23,32%

REFERENCES

Badan Perencanaan Pembangunan Nasional (Bappenas) dan Badan Pusat Statistik (BPS), 2013, "ProyeksiPenduduk Indonesia 2010-2035", Badan Pusat Statistik, Jakarta.

Basu, P., 2010, "Biomass gasification and pyrolysis : practical design and theory", ISBN 978-0-12-374988-8, Elsevier Inc., Oxford.

Brownsort, P.A., 2009, "Biomass Pyrolysis Processes: Performance Parameters and Their Influence on Biochar System Benefits", Dissertation, University of Edinburgh, Scotland.

Bryden,M.,Still,D.,Scott,P.,Hoffa,G.,Ogle,D.,Bailis,R.,dan Goyer,K., 2005, "Design principles for wood burning cook stoves", Aprovecho Research Center, Partnership for Clean Indoor Air, Shell Foundation.

Persada, G.B., 2017, "Optimization The Commercial Coke Production from Palm Kernel Shells for Eco-Friendly Metal Mineral Processing Process in Indonesia", Publication, Master Program of System Engineering, Univesitas Gajah Mada, Yogyakarta

Sambandam, S., Balakrishnan, K., Ghosh, S., Sadasivam, A., Madhav, S., Ramasamy, R., Samanta, M., Mukhopadhyay, K., Rehman, H., Ramanathan, V., 2014, *Can Currently Available Advanced Combustion Biomass Cook-Stoves Provide Health Relevant Exposure Reductions? Results from Initial Assessment of Select Commercial Models in India.* International Association for Ecology and Health.

The Japan Institute of Technology, 2008, “The Asian Biomass Handbook: A guide for Biomass Production and Utilization”, Tokyo, Japan.

Zhang, Q., Watanabe, M., Lin, T., DeLaquil, P., Gehua, W., danAlipalo, M.H., 2010, *Rural biomass energy 2020*, Mandaluyong City, Philippines: Asian Development Bank

CREATIVE AND INNOVATIVE PRODUCTS MATERIAL FLOOR FROM SHELLFISH *(Anadara grandis)*

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Abstract

The potential wealth of marine resources such as marine fisheries resources is owned by Indonesia. The wealth of marine resources has not been utilized and managed optimally. Today, a lot of business is driven in various fields. The business of building floor crafts from sea shells *(anadara grandis)* can be pioneered into one form of business. Buton Regency is an archipelago, more than 80% of its territory consists of sea. During this time, shellfish cultivated fishermen only used the meat alone, while the shell removed and become waste. This research is aimed to utilize shell waste into floor material. The method used in this research is exploration method. The data begins with the selection of materials, work tools, and stages of manufacture. Information from various sources is captured and interpreted into a creative idea. The process of analysis is done qualitatively, so it is obtained and raised the shape of the floor. This study concluded that the use of waste shellfish shells into composite floor material is done in three stages. In the first stage, prepared work tools such as glass molds, measuring cups, stirring spoons, brushes, flooring boards, measuring tools, hammers, cutter knives, sandpaper and plastic. The second stage is prepared work materials such as shells, hardener, resin oil, and mirror glass. The third stage is made of floor like shell stage filled with resin oil; The floor stage is printed like a glass mirror smear on the mold, the resin oil is mixed with the hardener, the composite mixture is poured into the mold, the shells are placed in the mold, the shells are poured again with resin oil, and hardener; Stage of removable glass mold and; Floor stage given ballast.

Keywords: Floor, composite, shellfish, stage created

INTRODUCTION

Indonesia is called the largest archipelagic country and maritime nation in the world. Waters area is the largest part of the total area of

Indonesia. Indonesia has a wealth of potential marine resources such as marine fisheries resources, marine cultivation, marine agriculture resources, and mangrove timber. Wealth of marine resources has not been utilized and managed optimally (Adisasmita, 2010). Currently, many businesses are driven in various fields, ranging from home industry, medium, to macro business. Types of goods used for business also vary, ranging from food, clothing, and household goods at low prices up to hundreds of millions of rupiah (Sari, *et al*., 2013).

Sea shells *(Anadara grandis)* are found in Indonesian waters. These shellfish are consumed by the community because they contain lots of protein. During this time, shells tend to be less utilized optimally. Clamshell wastes can be utilized as creative and innovative products such as eco-cement, floors, walls, ornaments, accessories, and starch materials. Portland cement is the largest structural component material required in the construction field. Currently, portland cement used as a sustainable material is an important goal. Alternative raw materials that can be used as replacement of waste-based and environmentally-friendly limestone are shell waste. Ash shells used in the cement making process have the potential as a lime replacement called eco-cement. Eco-cement can be used on light construction work (Syafpoetri, *et al*., 2013). Waste shells that are used as aesthetic elements of the building is one way to raise the locality of the marine archipelago. Shellfish can be utilized in building elements especially floor and wall. The material forming of new materials is influenced by the diversity of shapes and texture colors. Aesthetic flooring material from shell is adapted to the shell shape, motif, and texture of the shells.

Ornaments and accessories made as a business opportunity have a market share. It is based that many people are enthusiastic when buying decoration items and accessories. Ornaments and accessories can be made more unique and look beautiful when created creatively and innovatively (Sari, *et al*., 2013). Regarding the

CCRF (Code of Conduct for Responsible Fisheries) provisions, the fishery business should be optimized and environmentally friendly. The large amount of solid waste shell shells produced requires serious efforts to be addressed. Calcium content in shellfish can be used in cookies. Shellfish flour shell flour with 2N HCl produces the highest levels of calcium. Shellfish shell flour used in cookies products add nutrient content (Agustini, *et al*., 2011). Thus it can be concluded that shellfish waste can be utilized as a creative and innovative product thus increasing the income.

Composite is a combination of matrix material that is bonded and reinforced with filler material. The matrix is formed by a composite and bonded with a filler. In general, the composite material used is a thermoset resin adhesive. According to data from the Recycling Workshop in 1993 that waste plastic discharged in large cities reached 4,755 tons per day where 7% were plastic. When this plastic bag waste is dumped into the environment will pollute the environment. One of the materials formed by wood composites is sawdust. Composites made from flexible plastic waste and sawdust can be applied to floor coverings (Nurhajati, et al., 2003). Methods that have been developed on the building's floor system are intended for accelerated implementation process and the use of wood is reduced through precast concrete. Steel-concrete and wooden composite floor plate systems are widely used, because of the following; 1) In the execution process only required scaffolding with a distance of about 1 m; 2) precast plate in the form of curve tile functioned as formwork; 3) Fused with concrete; 4) Preprinted components are assembled, molded whole beams, support beam combined with floor plate, and casted in place (Triwiyono, et al., 2010). One effort to optimize the utilization of wood is done by using the remaining sawn timber for the production of composite floor boards. The making of floor boards from the rest of the processed wood is more efficient than the making of floor boards that use the rest of the wood. The remaining processed wood for optimal floorboard products is utilized as surface coating material and for panel products (Fakhri, et al., 2010). One of the alternative floors used in multi-storey buildings is composite floor plates of reinforced concrete. This wood component is functioned as a beam divider and as a floor plate. This precise technology is expected to be a complement to modular home buildings. The developed composite floor system produces the trend of beam capacity curve to be a ductile. The wood-reinforced concrete composite system can be an alternative to the floor structure system (Pranata and Kristianto, 2016). Thus it can be concluded that the building floor can be made of composite with different filler material.

The business of building floor crafts from sea shells *(Anadara grandis*) can be pioneered into one form of business. Buton Regency is an archipelago, more than 80% of its total area or ± 21,054 km2 consists of sea. Potential fisheries and marine is quite high owned by this region, such as coral reef ecosystems, seagrass ecosystems, mangrove forests, and high seas. Cultivated Mollusca commodities such as pearl shells, japing shells, fur shells, green shells, abalone, lola, axes, and giant kimah. The coral and sand substrate biota are inhabited by lola and abalone in Lasalimu, South Lasalimu, Batu Atas, Sampolawa, Siompu, Lakudo, Wabula, and Mawasangka. During this time, shellfish cultivated fishermen only used meat, while the shell is removed and become waste. Thus, this phenomenon is captured and processed creatively and innovatively as a floor material. This research is aimed to utilize shell waste into floor material.

METHODOLOGY

The method used in this research is exploration method. Data begins with the selection of materials, work tools, and stages of manufacture. Information from various sources is captured and interpreted into a creative idea. The basic concept is done and developed pragmatically on the shape of the floor. The process of analysis is done qualitatively, so it is obtained and raised the shape of the floor. The ground floor shape obtained is transformed from the parameters to the resulting flooring of clamshells and can be applied to the building.

RESULTS

Work Tools

The work tools used to make flooring material from shellfish *(anadaragrandis)* are, as follows: 1) Glass molds made of clear glass type with 5 mm thick. The glass mold is made as follows: The first glass mold is made base mold with the size 250 mm x 250 m. A second mold is made of a frame placed on top of the base mold. The frame is made according to the size of the base print. The thickness of the molded frame made is 10 mm, because the frame of the mold is arranged into two layers. The inner mold thickness is 10 mm. The frame mold placed on the base mold is adhesive by using a mixture of resin and hardener by dripping on the edge of the base mold. All of the frame frames at the angular assembly are patched with *plastisin*to keep the wet composite material out of the mold. Thus, mold of floor material from shells is formed; 2) Measuring cup used glasses of mineral water with dosage 240 ml; 3) The stirrer spoon is used to stir the mixture of resin and hardener oil to mix evenly; 4) The brush is used to smear the glass mirror on the glass mold so that the floor material is not sticky when lifted from the mold; 5) The boards used are plywood boards or gypsum that have been unused. This tool is used as an idler during the printing stage to allow the floor volume to be flat and symmetrical; 6) The measuring instrument used is meter and ruler; 7) Stationeries are used during the manufacture of prints such as markers; 8) The hammer is used to break shells that are not fit in the mold and to destroy the shells. The crushed shells are used as floor fillers; 9) The cutter knife is used to cut out the edge of the mold that appears; 10) The abrasive tool is used to smooth the sides of the printed floor for aesthetics; 11) *Plastisin* is used to cover the gap at the assembly of the frame so that the liquid in the mold does not come out of the mold.

Work Materials

Figure 1. Working materials used to make flooring material from shellfish

The working materials used to make the floor material from the shells *(anadara grandis)* are (shown in Figure 1), as follows: 1) Seed shells used are taken from Pasarwajo Sub-district, Buton Regency. The characteristics of shellfish from this area of the most prominent are clean white as sand. So good when used as a material filler floor of shellfish. Shellfish prior to use as a floor material should be washed with clean water and laundry. Whole shellfish is used as the main object of floor material. Shellfish are crushed as filler elements and placed between the complete shells, so that the filler material in the mold becomes solid. The size of the shells used as floor fillers varies, so the shell material placed in the mold appears. The maximum size of whole shells inserted as filler material is 15 mm. The size of the shellfish exceeding that size is destroyed as a floor filler; 2) Hardener is used as an accelerating material to harden the composite material. The price of one bottle of hardener sold in the market is Rp 7 000 (Seven thousand rupiah) per bottle. The hardener composition used for resin oil to create a floor with a size of 200 mm x 200 ml is 4 ml; 3) The resin oil used per 240 ml dose of the hardener is 2 ml (99%: 1%). Price of 1 kg resin oil valued Rp 4 000 (Forty thousand rupiah). One piece of floor material with a size of 200 mm x 200 mm is used 480 ml of resin oil. Resin oil functioned as the main raw material for forming flooring; 4) Mirror glass functioned as a polishing material before the mold is filled so that the floor easily separated from the mold. Mirror glass one tin valued Rp 150 000 (One hundred fifty thousand rupiah).

Floor Stages Created

Stage of Shells Filled with Resin Oil

Fan shaped shells are filled one by one using resin and hardener oils with the content composition used 99%: 1%. The filling of the composite mixture against these shellfish is intended to make solid shell so that the floor is sturdy. The shells filled with quick dry oil resin for about 5 minutes. This stage of the preparation is done with great care that the mixture of resin and hardener oil is not spilled (shown in Figure 2).

Figure 2. Fan shaped shells filled with a mixture of resin and hardener oils

Printed Floor Stage

The stages of the floor are printed (shown in Figure 3), as follows: 1) Mirror glass is smeared with brush on a glass mold. Mirror glass smeared across the glass surface including the thick edges of the glass. The more glass mirrors smeared in the mold the easier it is to release the floor; 2) Oil resin and hardener mixed with 99%: 1% composition. The mixture is stirred with a spoon to keep it flat; 3) The composite mixture is poured into a mold with a thickness of 3-4 mm and is waited until it is rather dense. Solid composites are known by piercing with stick; 4) Mixture of composite that began solid put shells. The shells are placed one by one and close together. The shapes and types of shells used as floor fillers vary. The gaps between the shells are filled with shellfish crushed in order to be aesthetically pleasing. The shell stage placed in the mold needs to be done quickly, because to anticipate a quick solid resin mixture; 5) After all the shells have been installed immediately pour the resin oil mixture over the entire shell surface. Poured resin oil needs to get out of mold. At this stage it should be carefully observed so that the mold is not tilted. Sloping mold is feared uneven floor thickness. At this stage also need to be observed because of frequent bubble phenomena. The empty air inside the mixture is called a bubble phenomenon. This happens because the heat from the composite mixture presses the air from the shells. This phenomenon is anticipated by removing the air by stabbing it with a stick. After the floor is printed and waited until solid for 10 minutes. Floors that have been dry and dense can be known by the way when touched hot.

Figure 3.Stages of printed floor

Matter Glass Removed Stage

After the floor is hot touched immediately remove the mold frame with great care so as not to damage the floor (in picture 4). Frames should be opened on both sides in advance. After the floor is not too hot, the next frame is released.

Figure 4. Frame mold removed from solid floor

The Weighing Stage is Placed on The Floor

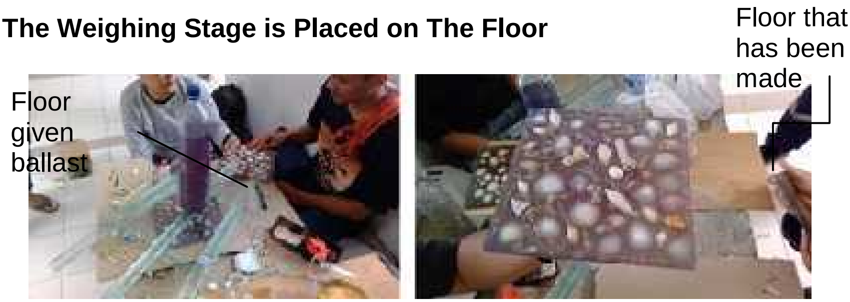

Figure 5. The floors are weighted in the corners and floors that have been created

The removable floor material has the potential of curved corners due to the heat released from the composite mixture. This is anticipated by weighing the corners of the floor. Loads that are fed on the floor corners for 15-20 minutes or until the floor is not hot. After that, the floor is released from the ballast above it. Thus, the floor material formed from the shell is flat and the corners are not curved.

The size of the floor material made is 200 mm x 200 mm x 5 mm. The amount of floor material made is one piece (shown in figure 5).

CONCLUSIONS

This study concluded that the use of waste shellfish shells into composite floor material is done in three stages. In the first stage, prepared work tools such as glass molds, measuring cups, stirrer spoons, brushes, flooring boards, measuring tools, hammers, cutter knives, sandpaper and plastisin. The second stage is prepared work materials such as shells, hardener, resin oil, and mirror glass. The third stage is made of floor like shell stage filled with resin oil; The floor stage is printed like a glass mirror smear on the mold, the resin oil is mixed with the hardener, the composite mixture is poured into the mold, the shells are placed in the mold, the shells are poured again with resin oil, and hardener; Stage of removable glass mold and; Floor stage given ballast. This study can be continued to calculate the flexural strength and tensile strength of the flooring material from the seams with different treatments.

REFERENCES

Adisasmita, R 2010, *Pembangunan Ekonomi Maritim*, Universitas Hasanuddin: Makassar, pp. 1.

Agustini, T, W, Fahmi, A, S, Widowati, I, &Sarwono, A 2011, *Pemanfaatan Limbah Cangkang Kerang Simping (amusium pleuronectes) Dalam Pembuatan Cookies Kaya Kalsium (Utilization of Asian Moon Scallop (Amusium pleuronectes) Shell Waste on Making of Calcium-Rich Cookies),* Jurnal Pengolahan Hasil Perikanan Indonesia, Vol XIV No 1, 8-13, pp 8-9, 13.

Armando, A, W 2013, *Pemanfaatan Limbah Kulit Kerang Simping Menjadi Elemen Estetika Bangunan (Penerapan Pada Lantai dan*

Dinding Bangunan) (The Utilization of Scallop Shells Waste as an Aesthetic Element of the Building), Thesis Undergraduate, Universitas Brawijaya, Fakultas Teknik, Jurusan Arsitektur, pp 15.

Fakhri, Gussyafri, H, danSyafruddin, 2010, Pemanfaatan Sisa Potongan Kayu Olahan Untuk Produk Papan Lanta iKomposit, Jurnal Aptek, Vol 3 No 1 Januari, hal 79, 83.

Nurhajati, D, W, Yuniari, A, & Herminiwati 2003, *Komposit dari Sampah Plastik Fleksibel dan Serbuk Gergaji (A Composit From Flextble Plastic Waste and Saw Dust)*, Majalah Kulit, Karet, dan Plastik, Vol 19, No I, hal 07, 12.

Pranata, Y, A, dan Kristianto, A 2016, *Pengembangan Sistem Lantai Komposit Berbasis Material Lokal Untuk Bangunan Kayu Bertingkat*, In Seminar Nasional Pengabdian kepada Masyarakat, Program Studi S-1, Teknik Sipil, Fakultas Teknik, Universitas Kristen Maranatha, hal 424, 430.

Sari, E., D., T., Rismana, A., D., Suseno, Tyas, C., A., & Lailassalami, U, 2013, *Pemanfaatan Kerang Laut Untuk Usaha Souvenir Buatan Tangan,* in Program Kreatifitas Mahasiswa, Fakultas Ilmu Komputer, Universitas Dian Nuswantoro, Semarang, pp 1-2.

Syafpoetri, N, A, Olivia, M, dan Darmayanti, L 2013, *Pemanfaatan Abu Kulit Kerang (Anadara grandis) Untuk Pembuatan Ekosemen*, Jurusan Teknik Sipil, Fakultas Teknik, Universitas Riau, Pekanbaru, pp 1-2, 14.

Triwiyono, A, Siringoringo, P, Ndaru, A, Ohlin, Z, Ilham, P, & Tatyana, A 2010, *Sistem Lantai Komposit dari Bahan Pracetak Support Beam, Curve Tile dan Beton Cor di Tempat*, in Prosiding Seminar HAKI Jakarta, pp 1, 8.

CREATIVE AND INNOVATIVE PRODUCTS OF NIPAH LEAVES (*Nypa fruticans wurmb*.) WITH SUSTAINABLE

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Abstract

The principle of energy saving is owned by sustainable architecture. The idea of sustainable building design by Indonesian architects tends to be low. One of them is caused by researchers in the field of architecture of local materials that can be developed into creative and innovative building materials tend to stagnate. Some notes from experience show that low-energy building materials use natural building materials and are quickly replaced by nature. Building materials from nipah *(nypa frutican wurmb.)* can be used to apply sustainable architectural principles. In Petoaha Sub District, Abeli District, Kendari City is located Kampung KB *(Keluarga Berencana*) that stretches on the sea. One of the activities of the famine filled by the mother by making the roof of palm leaf. The leaves are taken from the palm trees that grow around Kampung KB. During this leaf only made nipah roof. Thus, it takes creative and innovative products in addition to making the roof. Nipah leaves can be used as an alternative to composite products such as boards. This research is aimed to make composite board material from nipah leaf so that it can be used as creative and innovative product that is sustainable. This research used exploration method. The data begins with the selection of materials, work tools, and stages of manufacture. Information from various sources is captured and interpreted into a creative idea. The analysis process is done qualitatively. The shape of the basic board is transformed from the parameters to the resulting creative and innovative products in the form of bookshelves. The result of this research is concluded that the way to make composite board material from nipah leaf so that it can be used as creative and innovative product which continuously done with three stages. In the first stage, prepared work tools such as glass molds, measuring cups, stirring spoons, brushes, gauges, markers, sandpaper, plastic, hacksaws, basins and putty spoons. The second stage of prepared materials such as nipah leaf, hardener, resin oil, and mirror glass. The third stage is made of boards like nipah leaves cut, leaves mixed with resin oil and hardener, dough dried wind, board removed from frame mold, board weighted, and board made bookcases.

Keywords: nipah leaves, composite board

INTRODUCTION

Starting from the awareness that our earth has limitations, it is absolutely necessary to do harmony between nature and human (Wahyudi, 2012). This condition of the earth's limitations is caused by global warming due to increased CO_2 emissions in the atmosphere. Global warming is a phenomenon and increasingly sought solutions. This condition is also directly addressed by the World Agency under the United Nations and pioneered the idea of sustainable development (Prianto, 2007; Pramitasari and Iyati, 2011). At the 2015 United Nations Climate Change Conference in Paris the Paris Accord was reached. In the Paris Accord it is agreed that global warming is limited to a maximum of 20 Celsius (Wikipedia contributors, 2016). In the field of architecture grown and developed also the idea of sustainable building design. It is necessary to design in harmony with nature in order to utilize energy efficient (Prianto, 2007). The principle of energy saving is owned by sustainable architecture (Karyono, 2010). The idea of sustainable building design by Indonesian architects tends to be low. One of them is caused by researchers in the field of architecture of local materials that can be developed into creative and innovative building materials tend to stagnate (Greeners Media Online, 2014). Some notes from experience show that low-energy building materials use natural building materials and quickly replaced by nature (Wahyudi, 2012). Therefore, how a sustainable design is challenged and translated by the world of architecture today (Prianto, 2007).

Nipah leaf building materials *(nypa frutican wurmb.)*can be used to apply sustainable architectural principles. In Petoaha Sub Distric, Abeli District, Kendari City is located Kampung KB (Keluarga Berencana) that stretches on the sea. Kampung KB lies in coastal reclamation. The number of residents in Kampung KB is estimated to be 400 people and inhabited by the Bajo ethnic community who work as fishermen. Everyday fathers are busy catching fish in the sea. Mothers in Kampung KB are busy looking for *metti-metti (kalandoe / molusca bivalvia*) and making roof material from nipah leaves. Nipah leaf roof material is made with hereditary methods and is not made any time (made in the period of high winds). The high wind season occurs in July and August which makes sea waves high and unpredictable, so fishermen are difficult to go to sea. One of the activities of the famine filled by the mother by making the roof of palm leaf. The leaves are taken from the palm trees that grow around Kampung KB. During this leaf only made nipah roof.

The research of composite board of the *palmea* plant species studied is nipah leaf stalk and bengle stem, pandanus leaf *(pandanus spp)*, sago palm, and coco fiber waste and Polypropylene Plastic (PP). The research of nipah leaf particle board and bengle stem particle board have been studied by Wulandari (2012) which states that particle board is a panil product produced by compressing wood particles and simultaneously binding with an adhesive. Particle board is one of the most environmentally friendly composite board products, because its raw materials come from a variety of wastes, such as forestry waste, agriculture, plantations, and household waste (scrap paper and plastic). Based on the description of physical and mechanical properties of particle board of nipah leaf and bengle stem particle board, it can be concluded that it has fulfilled the standard of SNI (1996) except in the thickness development test does not meet the standard. The best particle board on both types of boards is particle board from nipah leaf with 15% adhesive composition (A2B3) with value of 8.088% moisture test, 0.725 g / cm^3 density, 13,050% thickness development, MoR 40,230 kg / cm^2 and MoE 3781,390 kg / cm^2.

Meanwhile, the type of palmea plants such as pandan leaves (pandanus spp). can be made into a composite board has been investigated by (Anastatica, 2009) stating that the physical properties of the board produced are as follows: Density (0.47 g / cm^3), moisture content (15.37%), thick development (69.27 %), and heavy shrinkage (7.12%). The mechanical properties of the board are as follows: elastic modulus / MOE (10.652.52 kg / cm^2), broken modulus / MOR (75.02 kg / cm2), and internal stickiness (3.90 kg / cm^2). The nature of the resulting composite board has not met the SNI 01-5008.2-2000 standard, and the adhesive type treatment affects the board properties of density, moisture content, thickness development, elastic modulus (MOE), broken modulus (MOR), and internal stickiness, weight density, elasticity modulus (MOE), modulus of fracture (MOR), and internal stickiness of board.

Another type of *palmea* plant that has been studied for composite board is sago stem. In this study we tested the resistance of composite boards from sago stem using Polyurethane (PU) and Phenol Pormaldehyde (PF) adhesives to mold and termite fungi. The size and target density of the composite board is 30 cm x 30 cm x 1 cm^3 and 0.5 g cm^3. The composite board is composed of a cold-pressed sago heap composite for composite board using PU adhesive and hot forging for board using PF adhesive with a specific pressure of 25 kg cm^2 for 24 hours for cold forging and 10 minutes for hot forge at 140 ° C. solid and liquid adhesive is 50% with variation of adhesive level used in this research that is 10%, 12% and 14%. Tests based on the JIS K 1571 2004 standard. Based on the percentage of weight loss, the composite board using PU and PF adhesives can not stand the fungus and termite fungus attacks (Zulfiana and Kusumah, 2014).

The type of palmsa plant in the form of coconut fiber waste and Polypropylene Plastic (PP) recycled as raw material of composite board have been studied by Setyawati, et al., (2008) stating that in general research of plastic wood plastic composite board is more focused on extruded material where the wood powder is used as a filler or reinforcement in the thermoplastic matrix, and only slightly has focused on the use of plastics in panel products such as particleboard and fiberboard. Furthermore it is said that the use of thermoplastics in the manufacture of particle board can The use of bamboo coating materials on the front and rear of the composite board can improve the mechanical properties of composite boards. All composite plated bamboo composite board meets JIS A 5908 1994 standard for the thick development properties and strong grasp of screws. The elasticity module of woven bamboo plated composite board with leather and pattern perpendicular to the width of 1 cm slats meets JIS A 5908 standard for veneered particleboard type. Judging from the efficient use of raw materials, it is advisable to use woven bamboo skinless with a plaited pattern perpendicular to the width of 1 cm slats. Thus it can be concluded that the type of palm plant from nipah leaf has never been studied as raw material of composite board. Therefore, researchers will examine further because as follows: 1) Nipah leaves is an endemic plant in Kampung KB; 2) The physical properties and particle board mechanics of the palmea plant species have met the SNI standard (1996); 3) The elastic modulus of species of palmea meets JIS A 5908 standard; 4) The type of palmea plant has the properties that are easy to forge.

Renewable energy is energy generated from a sustainable source of existence. Renewable energy tends to be environmentally friendly. Renewable renewable materials that lead to materials derived from vegetation such as wood, bamboo, and leaves. If the use of this type of material is maintained to be sustainable, then this type of material is recommended as a building. The material of vegetation material is a material that is formed not emitting CO_2, but instead absorbs CO_2 (Karyono, 2010). The air layer on the sidelines of the woven leaf is owned by the roof material of the leaf, so that the small conduction coefficient and heat are propagated into the low space (Astiningsih, 2012). Nipah *(nypa fruticans)* is a type of palm *(palma)* that grows in the mangrove environment. Large nipah forest area is owned by Indonesia. The area of nipah forest in the world reaching 35,000,000 hectares is estimated to be in Indonesia. Nipah forests are spread in Kalimantan, Sumatra, Sulawesi, Maluku, Papua, and nipah plants grow naturally (Yeni, et al., 2011; Khalil and Hidayat, 2006).

In forest management effort from Timber Extraction to Sustainable Forest Management is changed its course through Non Timber Forest Products (HHBK), because HHBK has strategic value. NTFP proved able to bring economic turnover at the local level so that it affects the improvement of welfare. Nipah leaf in addition to easy to obtain also affordable prices by consumers. The continuity of nipah roof craftsmen is highly dependent on raw materials, capital, skill, and marketing (Mastono, et al., 2013). The sustainable interior criteria that are owned by the dwelling house, as follows: 1) Efficiency of resources; 2) The air inside the room is kept of quality; 3) Energy efficiency and; 4) Water conservation. The production process of interior materials should also be efficient as production wastes are degraded and the greenhouse effect is reduced. Local materials should be used to supply home interior materials. In this case, the transport of materials to the site can be saved as energy and resources (Wibowo, 2009). Thus it can be concluded that the nipah leaf is a sustainable building material.Thus, it takes creative and innovative products in addition to making the roof. Nipah leaves can be used as an alternative to composite products such as boards and simultaneously applying the principles of sustainable architecture. This research is aimed to make composite board material from nipah leaf so that it can be used as creative and innovative product that is sustainable.

METHODOLOGY

This research used exploration method. The data begins with the selection of materials, work tools, and stages of manufacture. Information from various sources is captured and interpreted into a creative idea. The basic concept is carried out and developed pragmatically against the shape of the board. The process of analysis is done qualitatively, so that it is obtained and raised the shape of the board. The shape of the basic board is transformed from the parameters to the resulting creative and innovative products in the form of bookshelves.

RESULTS

The composite board material from the nipah leaves is made into a creative and innovative bookcase as well as sustainable, as follows:

Work Tools

The work tools used to make the composite board material from the nipah leaves are, as follows: 1) Glass mold made of clear glass type with 5 mm thickness. The glass mold is made as follows: The first glass mold is made base mold with the size of 750 mm x 650 mm. The base mold is divided into three sections with sizes of 600 mm x 200 mmand adjusted to board size. The base mold is simultaneously made three sheets of boards for quick manufacturing stage. The glass mold is divided into three parts for quick board making. A second glass mold is made of a frame placed on top of the base mold. Frame made according to board size. The thickness of the molded frame made is 10 mm, because the frame of the mold is arranged into two layers. The inner glass mold is made as thick as 10 mm. The frame mold is adhered to the base mold using resin and hardener oil. The comparison of resin and hardener oil used as a sticker is 10 ml of resin: 3 drops of hardener (as needed). The base mold is mounted in a glass frame and *plastisin.* After the frame is mounted from glass and *plastisin*, the composite board mold is formed; 2) Measuring cup used glass of mineral water; 3) The stirrer spoon is used to stir the resin oil and hardener to mix evenly; 4) The brush is used to smear the glass mirror on the glass mold so that the board material does not stick when lifted from the mold; 5) The meter and ruler are used as measuring instruments; 6) Stationery is used during the manufacture of prints such as markers; 7) The abrasive tool is used to smooth the sides of the floor that have been molded for aesthetics; 8) *Plastisin* is used as a frame on the mold so that the wet composite material does not spill out. *Plastisin* is used to conserve glass materials; 9) The hacksaw is used to flatten the uneven sides of the board especially on the part framed with *plastisin*; 9) The basin is used as a mixture of resin, hardener, and palm leaf oil. The used basin is two; 10) Spoon putty is used to gouge the board out of the mold.

Work Materials

The work materials used to make the composite board material from the nipah leaf (shown in Figure 1) are as follows: 1) Nipah leaves are taken around Wanggu River (Pasar Baru Bridge), Lalolara Village, Wuawua Clan, Kendari City. Leaf on the lower stalk is best used as a composite material, because the shape of the leaves is wide and thick. Thus, the leaves are good when used as a composite filler material. Nipah leaves before being used as a composite material should be soaked in sea water so that bacteria found on the leaves difficult to develop. Nipah leaves are soaked in soft textured water so easily mixed with resin oil and hardener. Nipah leaves that have been soaked dried in the sun directly. Nipah leaves dried in the sun for three days. Characteristics of nipah leaf that has dried grayish-brown. Nipah leaves dried in order to reduce the water content in the leaves and at the time of solid board does not occur bubble phenomenon. The bubble phenomenon is avoided to prevent cracks on the board; 2) Hardener is used as a material to accelerate the composite. Hardener in Kendari City valued Rp 7 000 (Seven thousand rupiah) per bottle. The hardener composition used for resin oil to make boards of 600 mm x 200 mm is 16 mm; 3) The resin oil used per 240 ml dose of hardener is 2 ml (99%: 1%). The resin oil used to make the board with the size of 750 mm x 650 mm is 1200 ml. Price of 1 kg resin oil valued Rp 40 000 (Forty thousand rupiah). One sheet of board with size 750 mm x 650 mm used 1200 ml of resin oil. The resin oil is used as the main raw material of the board; 4) Mirror glass is used as a topical on the mold to make the board easily detached from the mold. Mirror glass is smeared across the inner mold surface. Mirror glass one tin valued Rp 150 000 (One hundred fifty thousand rupiah).

Composite Board Stages Created

Stage of Nipah Leaf is Edited

Nipah leaf stages are cut, as follows: 1) Leaf bone is separated from the leaf because it causes bubble phenomena; 2) Leaves are cut out per 10 mm x 10 mm. Board density is influenced by small leaves; 3) Leaf squeezed by hand so that the composite mixture easily blends with the leaves (shown in Figure 1).

Figure 1. Nipah leaf stages cut out, nipah leaf stages mixed with resin and hardener

Leaf Phase Mixed Resin and Hardener

The leaf stage is mixed with resin and hardener oil, as follows: 1) Mold board with size 600 mm x 200 ml x 10 mm made with 1200 ml composition of resin oil: 8 ml hardener; 2) Leaves that have been cut in place on the basin. Leaves are put into a basin of about 6 handfuls; 3) The leaves in the basin are mixed with resin oil and hardener. The dough is stirred until blended. The mixed dough has characterized the resin oil is not lumpy; 3) The glass mold is smeared with mirror glass. Mirror glass is smeared across the mold surface. The edge frame mold is smeared with mirror glass. The more glass mirrors smeared in the mold the better. Mirror glass smeared in the mold needs to be done quickly so that the dough on the basin is not solid; 4) The dough is poured in the mold. Preferably the dough is not poured from the center, but poured in a way around the mold shape. The dough in the basin should be spent so that no material is wasted. Dough is poured in the mold should be done quickly because it is feared the dough in the basin to dry (solid). The solid dough on the basin is estimated to be two minutes; 5) The dough on the mold is leveled with a glass frame (a flat surface tool) to be flat and aesthetic (shown in Figure 1).

Stage Dough Dried Air

Figure 2. Dough stages dried wind

The leveled dough stage has finished, then the dough is waited until solid. The heat is expelled by a solid board and when the board is hotly touched. Solid boards are dried up until the boards are not warm (in figure 2). At this stage the bubble phenomenon is common. The bubble phenomenon is anticipated by means of a pierced bubble using a stick.

Stage The board is Removed from The Printed Frame

Figure 3. Frame stage removed from mold

The board stage is removed from the molding frame, as follows: 1) The board stage is removed from the mold preferably before the board is completely solid (shown in Figure 3); 2) Plasticin frame opened; 3) The board is gouged with a putty spoon. The board is gouged out on the plastic frame section. The plucked boards stage should be done with great care because the board is still flexible; 4) The board is moved in a flat place.

Stage Board Is Given A Weight

Figure 4. Stage board weighted

The board is weighted so that the board does not have a curve during the drying stage (shown in Figure 4). This stage can be done for 12 hours. After this stage is done, then the stage of composite board material from nipah leaf has been completed. Composite board material from nipah leaves that have been made amounted to 7 pieces. The board stage is made for 18 hours including the board stage is given ballast. Board size that has been made 600 mm x 200 mm x 10 mm.

Stage Board Created Bookshelf

Once the board is made, the composite board material from the nipah leaves is made into a creative and innovative bookcase (shown in figure 5).

Figure 5. Composite board material from palm leaves made of bookshelves

CONCLUSIONS

This research concluded that the way to make composite board material from nipah leaf so that it can be used as creative and innovative product which continuously done with three stages. In the first stage, prepared work tools such as glass molds, measuring cups, stirring spoons, brushes, gauges, markers, sandbrushes, plastisin, hacksaws, basins, and putty spoons. The second stage of prepared materials such as nipah leaf, hardener, resin oil, and mirror glass. The third stage is made of boards like nipple leaf cut, leaf stage mixed with resin and hardener oil, dough stage dried wind, stage board removed from frame mold, board stage weighted, and board stage made bookcase. This research can be continued to calculate the strength of bending and tensile strength of the composite board material from the nipah leaf with different treatment.

REFERENCES

Anastatica, Y 2009,*Studi Pembuatan Papan Komposit Anyaman Pandan (Pandanus spp) Menggunakan Perekat Epoxy dan PVAc (Polivynil Acetate),* Undergraduate Thesis, Departemen Hasil Hutan Fakultas Kehutanan Institut Pertanian Bogor.

Astiningsih, N, K 2012,*Pengaruh Bahan Atap Kandang Dan Strain Terhadap Penampilan Ayam Pedaging,* Jurusan Produksi Ternak, Fakultas Peternakan, Universitas Udayana Denpasar.

Greeners Media Online 2014, *Seminar Arsitektur Berkelanjutan; Arsitektur Tradisional untuk Bangunan Berkelanjutan,* Berita Harian, (Online), April, (http://www.greeners.com, diakses tanggal 6 Juni 2016).

Karyono, T, H 2010, *Green Architecture Pengantar Pemahaman Arsitektur Hijau Di Indonesia,* Cetakan ke-1, PT RajaGrafindo Persada: Jakarta.

Khalil dan Hidayat, T 2006,*Potensi Buah Nipah Tua (nypa fruticans wurmb) Sebagai Bahan Pakan Ternak,* Jurnal Peternakan Indonesia, 11(2):123-128.

Mastono, Jumani, dan Tirkaamiana 2013, *Peluang Usaha Atap Daun Nipah Bagi Masyarakat Di Kelurahan Timbau Tenggarong Kabupaten Kutai Kartanegara Provinsi Kalimantan Timur,* Jurnal AGRIFOR Vol XII, No 1, Maret.

Pramitasari, P, H, dan Iyati, W 2011, *Penerapan Konsep Arsitektur Hijau Pada Desain Rumah Tinggal Karya Arsitek Indonesia,* in Proseding Seminar Nasional The Local Tripod, Akrab Lingkungan, Kearifan Lokal, dan Kemandirian, pp 25.

Prianto, E 2007, *Rumah Tropis Hemat Energi Bentuk Kepedulian Global Warming,* Riptek, Vol 1 No 1, November, pp 1.

Setyawati, D, Hadi, Y, S, Massijaya, M, Y, dan Nugroho, N 2008,*Karakteristik Papan Komposit dari Serat Sabut Kelapa dan Palstik Polipropilena Daur Ulang Berlapis Anyaman Bambu,*Jurnal Ilmu dan Teknologi Hasil Hutan 1(1): 18-26.

Wahyudi, A, & Pratiwi, C, W 2011, *Eksistensi Bangunan Tradisonal Sunda Sebagai Pendekatan Keraifam Lokal, Ramah, Lingkungan, dan Hemat Energi,* in Proseding Seminar Nasional The Local Tripod, Akrab Lingkungan, Kearifan Lokal, dan Kemandirian, pp 53-54.

Wahyudi, A 2012, *Dari Pendekatan Ekologis Menjadi Langgam Arsitektur (Catatan Dari Pengalaman Mendesain Beberapa Karya Arsitektur)*, pp 114-115.

(Wikipedia contributors, “Konferensi Perubahan Iklim Perserikatan Bangsa-Bangsa 2015” *Wikipedia, The Free Encyclopedia,* Wikipedia, The Free Encyclopedia, 26 Okt 2016. Web, 26 Okt 2016.)

Wibowo, M 2009,*Strategi Pemilihan Material 3R Rumah Tinggal Dalam Desain Interior Sebagai Adaptasi dan Mitigasi Perubahan Iklim,*Desain Interior, Fakultas Seni dan Desain, Universitas Kristen Petra.

Wulandari, F, T 2012,*Deskripsi Sifat Fisika Dan Mekanika Papan Partikel Tangkai Nipah (Nypa fruticans Wurmb) Dan Papan Partikel Batang Bengle (Zingiber cassumunar Roxb),* Media Bina Ilmiah 7, Vol 6, No 6, Desember.

Yeni, L, F, Hidayat, A, & Marlina, R 2011,*Isolasi dan Aktivitas Fermentasi Bakteri Asam Asetat Pada Nira Nipah,* Jurnal Pendidikan Matematika dan IPA Vol No 1 Januari: 1-10.

Zulfiana, D, & Kusumah, S, S 2014,*Ketahanan Papan Komposit Dari Pelepah Sagu (Rottb) Terhadap Jamur Pelapuk Dan Rayap Tanah,*Jurnal Penelitian Hasil Hutan Vol 32 No 4, Desember: 253-262.

IDENTIFICATION OF ENERGY CONSERVATION MEASURES OF BATIK AND FURNITURE INDUSTRIAL CLUSTER IN CENTRAL JAVA PROVINCE

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Abstract

Energy consumption of industrial areas in Indonesia plays significant role. About 400 Mega Tonnes CO_2 of Green House Gasess (GHGs) eqivalent comes from energy sectors. Since many attempts have been developed to decrease cost of energy utilization, energy efficiency can be an alluring program for several industrial sector specifically those who consume intensive energy for production procesess.The objectives of the paper are measuring GHGs emissions from stationary sources and identifying potential measures in energy efficiencies, both for batik and furniture industrial sectors in Central Java Province. Measuring GHGs emissions based on its energy utilization from production flow procesess. Both in Furniture Sukoharjo and Batik Sragen Industries exploit energy which originate from electrical energy, solid fuel and liquid-stationary fuel. Once total heatloss of thermal energy equipment (wood dry kiln, tungku lorodan, kerosene stove, boiler and steam system) is calculated using baseline data, potential CO_2 reduction could be obtained. The furniture cluster in Sukoharjo comprises 13 Small Medium Industries (SMEs) emits nearly 117 CO_2-eq tonnes/ year (electricity source), dry kiln’s heat loss estimation is 68-72%, and have potential dry kiln’s energy saving 6-11%. The batik cluster in Sragen comprises 10 SMEs using algodon material emits nearly 6.92 CO_2-eq tonnes/ year (electricity source), 144.83 CO_2-eq tonnes/ year (kerosene source) and 10.13 CO_2-eq tonnes/ year (firewood source). Solar energy, the fully-free GHSs, can be used regularly than sawn timbre for wood processingin the furniture cluster in Sukoharjo while SMEs owner in the batik cluster in Sragen can change kerosene stove to gas stove in attempting energy efficiency.

Keywords: energy, GHGs, industrial clusters, efficiency

INTRODUCTION

Indonesia, the third green house gas (GHG) emitter in earth after China and US (Reuters 2017), is vulnerable to cope with climate change impact. About 3,000 Mega Tonnes CO_2 of GHG eqivalent in Indonesia comes from deforestation and forest fire (Pelangi Foundation 2011). Additionally, just around 400 Mega Tonnes CO_2 of GHG eqivalent comes from energy sectors. Both adaptation and mitigation approaches on reducing climate change impact haven't done seriously in Indonesia nowadays. It requires responsibility, from goverment as policy maker and industrial enterprises as energy consumer.

Energy consumption in industrial areas plays significant role. Since many attempts have been developed to decrease cost of energy utilization, energy efficiency can be an alluring program for several industrial sector specifically those who consume intensive energy for purposes. As well as potential energy efficiency is developed, the industrial processes also generate wastewater or organic solid wastes which must be considered as all kind of relevant GHGs.

The objectives of this paper are measuring of GHG emissions from stationary sources for selected industrial sectors and the identification of potential measures in energy efficiencies for selected industrial sectors and clusters on Central Java Province is established. Target of the paper is providing further chance for intervention related to the improvement of climate change strategies in industrial level of small to medium enterprises (SMEs). Batik and furniture SMEs cluster in Central Java play significant role in having a lot of energy consumption (GIZ PAKLIM 2012), therefore are chosen for identification of energy conservation.

METHODOLOGY

In this paper, identification of energy input will be carried out (assuming that electrical energy and fuel input fully transformed into GHG emission) based on flow process production that comes from baseline data's each cluster. Once energy input was identified, energy data for clusters could be obtained (Figure 1).

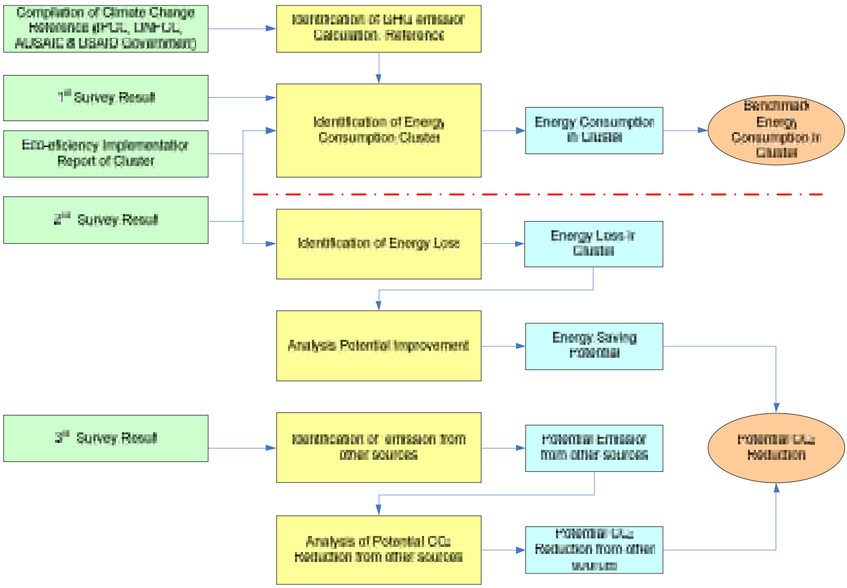

Figure 1 Methodology of identification for energy conservation in the cluster

Theoretical Energy Emission Measurement

Measurement of energy emission in two selected cluster based on its energy utilization from production flow processes. Both in BulakanSukoharjo Furniture and MasaranSragen Batik exploit energy which originate from electrical energy (for pump and electricity purposes), solid fuel (for dry kiln, steam and wood stove purposes), and liquid-stationery fuel (from oil-burning stove). Hence, references of theoretical energy emission only consist of electrical and fuel energy.

A. Electrical Energy

Based on UNEP (2006), consumed electrical energy will be fully transformed to be CO_2 emission. CO_2 emission calculation on electrical energy comes from monthly electrical bill of payment called *kilowatt hours* or kWh multipled by emission factor on each country.

$$CO_2 \text{ Emission} = Q_{mWh} \times EF$$

Where :

CO_2 Emission = summary of CO_2 emission generated every year (tonnes CO_2/year)

QMWh = actual energy quantities (MWh) every year

EF = emission factor, for Indonesia is about 0.724

B. Fuel Energy

Solid Fuel

This method is derived from the *National Greenhouse Account* national methodology as published in the *National* Inventory *Report* (the Commonwealth of Australia 2008). The approach is similar to that taken for the estimation of emissions from the Greenhouse Challenge Plus program by UNFCC.

Liquid Fuel For Stationery Purpose

Emissions are estimated for individual fuel types by multiplying a (physical) quantity of fuel combusted by a fuel-specific energy content factor and a fuel-specific emission factor for each relevant greenhouse gas (in this case, carbon dioxide, methane and nitrous oxide).Energy content and emission factors required for the estimation of emissions using this approach are given below. These factors are intended to be default factors – to be used in the absence of better information.

Thermal Energy Equipment for Heatloss Calculation

Heat loss calculation of thermal energy equipment is taken from www.energyeficiencyasia.org/energy_equipment/thermal. In Bulakan furniture SMEs are using furnace : wood dry kiln as thermal energy equipment. In Masaran batik SMEs are using *tungkulorodan* (traditional kiln for lorodan), kerosene stove with 6-10 wick, boiler & steam system.

Furnace : Wood Dry Kiln

Furnaces are broadly classified into two types based on the heat generation method: combustion furnaces that use fuels, and electric furnaces that use electricity. On this section, wood dry kiln as traditional furnace is used in Bulakan furniture industry to dry sawn timbre instead of manual solar drying.

Ideally, all heat added to the furnaces should be used to heat the load or stock. Furnace efficiency is calculated after subtracting the various heat losses. A furnace's efficiency increases when the percentage of heat that is transferred to the stock or load inside the furnace increases (Holman JP 1988). The efficiency of the furnace can be calculated in two ways, similar to that of the boiler: direct method and indirect method. Both methods are explained below :

A. Direct Method

The efficiency of a furnace can be determined by measuring the amount heat absorbed by the stock and dividing this by the total amount of fuel consumed.

The quantity of heat (Q) that will be transferred to stock can be calculated with this equation:

$$Q= m \times C_p(t_1-t_2)$$

Where, Q = Quantity of heat of stock in kCal m = Weight of the stock in kg

C_p = Mean specific heat of stock in kCal/kg^{o}C

t_1= Final temperature of stock in ^{o}C

t_2= Initial temperature of the stock before it enters the furnace in ^{o}C

B. Indirect Method

The furnace efficiency can also be determined through the indirect method, similar to the evaluation of boiler efficiency. The principle is simple: the heat losses are substracted from the heat supplied to the furnace. Typical thermal efficiencies for common industrial furnaces are 35-40% (BEE 2005).

Boiler and Steam System

A. Boiler

The performance parameters of a boiler, like efficiency and evaporation ratio, reduces with time due to poor combustion, heat transfer surface fouling and poor operation and maintenance. Even for a new boiler, reasons such as deteriorating fuel quality and water quality can result in poor boiler performance. A heat balance helps us to identify avoidable and unavoidable heat losses. In the MasaranSragen Batik industry, they use boiler and steam system to lock their colored batik which made from silk material before lorodan stage is held.

Thermal efficiency of a boiler is defined as “the percentage of (heat) energy input that is effectively useful in the generated steam.” There are two methods of assessing boiler efficiency :

a. The Direct Method: the energy gain of the working fluid (water and steam) is compared with the energy content of the boiler fuel.

b. The Indirect Method: the efficiency is the difference between the losses and the energy input. The indirect method won't be discuss further here because of uncompleting base line data of boiler in the MasaranSragen batik.

B. Steam

The steam system in MasaranSragen batik cluster is simple and different from others. It would be insulated to conserve energy in the heating system. A thermal insulator is characterized by a low thermal conductivity and is therefore able to keep heat confined within or outside a system by preventing heat transfer to or from the external environment (Grisworld J 1946). Insulation materials are porous and contain a large number of dormant air cells. A large amount of heat energy may be lost without insulation or if insulation is inefficient or improperly installed.

Kerosene Stove with 6-10 Wick

Efficiency level of kerosene stove as cooking convection equipment divides two parts, efficiency from kerosene stove itself and efficiency from cooking equipment.Kerosene stove efficiency is stove ability to get heat from fuel combustion, the bigger heat generates, the higher efficiency level will be gained. On the other hand, efficiency from cooking equipment is its ability to absorb heat from kerosene stove combustion result, the bigger heat absorbtion, cooking equipment will be more efficient. Kerosene stove in MasaranSragen batik typically has 6 – 10 wick.

The method for determining efficiency assessment is boiling water method. We can define total fuel needed for boiling water with fixed volume and find out requirement time. Thus, we can calculate efficiency through comparing total heat absorbed by cooking equipment with total heat generated from combustion process.

Tungku Lorodan **(Traditional Kiln for Lorodan)**
Tungkulorodan efficiency calculation is in the same with kerosene stove efficiency calculation because both thermal equipment have similar process. The difference between tungkulorodan and kerosene stove is fuel material used. Tungkulorodan use fire wood as fuel, kerosene stove use kerosene as fuel. The efficiency calculation can be determined through comparing total heat absorbed by cooking equipment with total heat generated from combustion process.

2.2 Emission Generates from Another Source (Wastewater)

Total greenhouse gas emissions from domestic and commercial wastewater are summary of emissions from wastewater treatment and sludge treatment (Tchobanoglous *et al.* 2003). The total quantity of wastewater treated depends on the size of the population that is generating wastewater. The wastewater emission from MasaranSragen batik comes from total CH_4 converted into CO_2 in a year.

RESULT AND DISCUSSION

Result on Bulakan Sukoharjo Furniture

A furniture process needs more electrical and solid fuel (biomass) energy to sustain its production than other manufacturing practices. Using dry-kiln and various electrical kits are typically for furniture production process. These energy consumption will generate GHG emission (CO_2, CH_4 and N_2O). Therefore, more complex product means more energy requirement, and more GHG emission could generate.

In Bulakan Sukoharjo, furniture product consists of four major products. These products are cabinet, table-chair, handycraft and mirror. The general flow chart of production can be seen in Figure 2. Only several industries which have a lot of energy consumption and generate loads of emission are chosen for identification of energy conservation. Just about 540 small to medium scale furniture enterprises with four major products have taken a part. The author has picked up eleven small industries in this cluster to be calculated as key benchmark.

Energy Emission Measured

Energy & emission measured in this cluster consists of two sources, they are from electricity and from dry kiln's fuel (wood shaving, wood pellet and saw dust). Figure 3 presents energy consumption and energy emission from electricity source. Benchmark per raw material of log are 0.018 MWh/ year for electricity and 0.013 CO_2 emission tonnes/ year.

Figure 2. Furniture's flow process

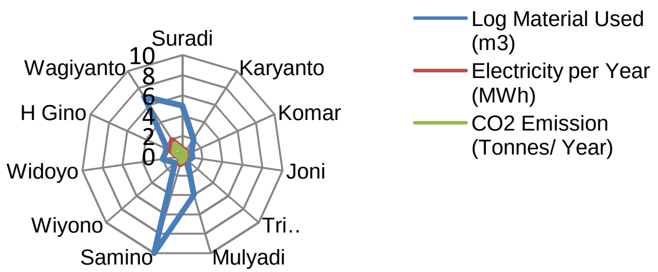

Figure 3 Energy consumption and energy emission from electricity used

More higher consumption bothfrom log material used and electricity used, more higher CO_2 emission emitted. Total raw material of log needed from 540 SMEs is 9000 m^3 or same with 161.6 MWh electricity used per year and emitted 117 CO_2 tonnes emission per year. Moreover, figure 4 presents energy consumption and energy emission from dry kiln's fuel usage.

Benchmark per raw material of log are 0.097 tonnes/ year for saw dust, 0.097 tonnes/ year for wood pellet, 0.725 tonnes/ year for wood chip and 0,027 CO_2 emission tonnes/ year. Total raw material of fuel needed from 540 SMEs is 82,713 tonnes/ year fuel used and emitted 2.44 CO_2 tonnes emission per year.

Table 1 presents wood dry kiln's potential energy saving approach in Bulakan furniture cluster. Energy saving approach for SMEs which use dry kiln for drying their product are:

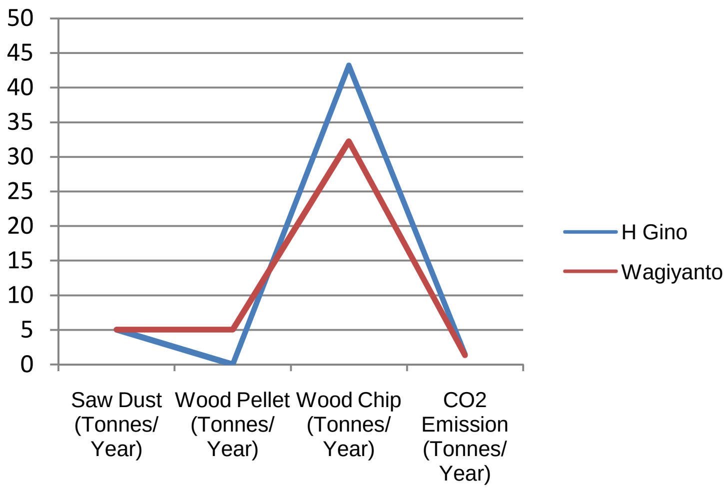

Figure 4 Energy consumption and energy emission from dry kiln's fuel usage

a. Reducing saw dust consumption, because saw dust fuel provides higher energy heatloss.
b. Exchanging whole of saw dust into fire wood.
c. Using solar energy more regularly than usual to dry-sawn timbre.

Table 1 Wood dry kiln's potential energy saving approach

Dry Kiln Specification			Before Improvement (%)		After Improvement (%)		Energy Saving
Fuel Type	Total Fuel Capacity	Stock Capacity	Efficiency	Heatloss	Efficiency	Heatloss	(%)
Saw dust;	0,5 m^3						
Fire wood;	1 - 1,5 m^3	3 - 4,5 m^3	28,32 - 31,56	68,44 - 71,68	37,13 - 39,12	62,87 - 60,88	5,57 - 10,8
Wood pellet	0,5 m^3						

Result on Masaran Sragen Batik

Batik industry, has various product of batik, uses widely energy equipment for sustaining the production process. The energy consumption from electricity (water pump, padding and mixer machine), liquid fuel (kerosene stove) and solid fuel (tungkulorodan) will generate GHGs emission (CO_2, CH_4 and N_2O).

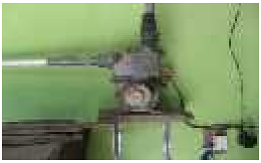

Figure 5 (From Left to Right) Electrical Equipment in MasaranSragen
Water Pump-Mixer-Padding


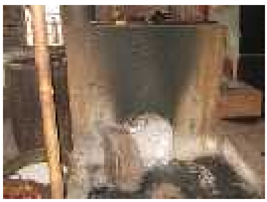


Figure 6 (From Left to Right) Thermal Equipment in Masaran Sragen
Boiler & SteamTraditional Kiln for LorodanKerosene Stove

In Masaran Sragen, batik product consists of three different process. These process production are batik tulis, batik cabut-tulis and batik cap-tulis. Only several industries which have a lot of energy consumption and generate loads of emission are chosen for identification of energy conservation. More than thirteen industrial small scale furniture enterprises with three different process have taken a part will be calculated as key benchmark to identify total energy consumption and emission in this paper. Both key benchmark and energy identification depend on raw material used : cotton algodon (mori) and silk, because production process of silk is more complex and generates lower capacity of cloth, differ from production process of cotton algodon (mori).

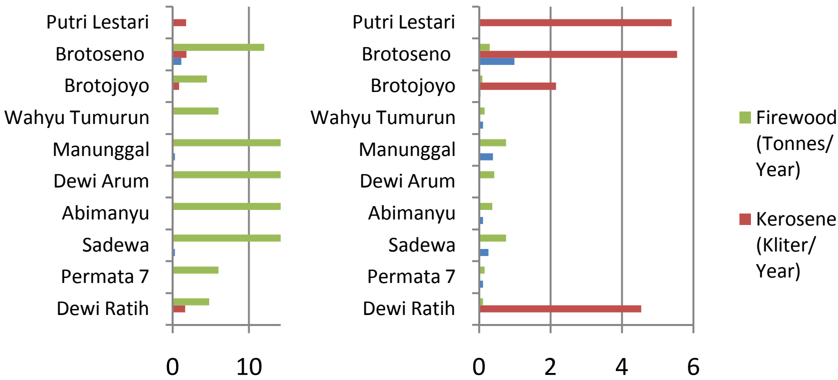

Figure 7 Energy consumption and energy emission using cotton algodon (mori fabric)
Source energy (Left); Output energy (Right)

Based on figure 7, eleven SMEs using firewood often than kerosene and electricity. Therefore, they are having kerosene as by product higher than firewood and electricity. Total fabric production from 41 SMEs is 502 900 m^2/ day, 468.12 tonnes/ year fuel used and emitted 161.89 tonnes/ year by product of fuel.

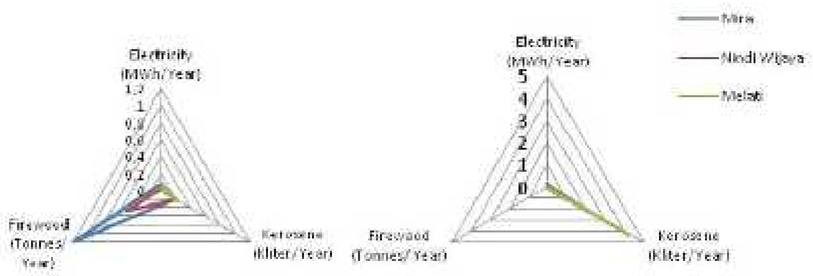

Figure 8 Energy consumption and energy emission using silk
Source energy (Left); Output energy (Right)

Only three SMEs based on figure 8 using firewood and are having kerosene as by product (Figure 8). Total silk cloth production from SMEs is 3480 m^2/ month, 7.99 tonnes/ year fuel used and emitted 1.93 tonnes/ year by product of fuel.

Table 2 presents thermal equipment heatloss in Batik Masaran cluster. Energy saving approach are :

a. Tungku lorodan : Increasing water capacity until maximum load on the water tank (tempayan), adding blower and isolator surrounding the burner room (tungku).
b. Boiler and steam : Adding isolator material for minimizing heatloss.
c. Kerosene stove : Increasing parafin wax capacity until maximum load on the frying pan or changing frying pan with greater diameter.

Simplified energy approaces (Table 2) for minimizing heatloss from thermal equipment have very low energy saving. Batik owner can exchange conventional equipment e.q. kerosene stove into gas stove if this attempt doesn't affect the whole production process. Meanwhile, based on waste water treatment plant (WWTP) Kliwonan data which

Table 2 Thermal equipments energy saving in Batik Masaran Sragen cluster

Equipment Specification (Typical)			Before Improvement (%)		After Improvement (%)		Energy Saving
Eq. Name	Total [illegible] Capacity	Dimension	Efficiency	Heat loss	Efficiency	Heat loss	(%)
[illegible]	35,25 kg/hour	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Heater & Steam	[illegible]	0,44 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Kerosene Stove	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

41 SMEs are flown their waste water, 808 mg/ L chemical oxygen demand (COD) and 82 mg/ L total suspended solid (TSS) are produced. Estimated wastewater emission in the cluster is 22 tonnes CO_2-eq/ year respectively. Batik Brotoseno (Figure 9) is the industry which produces highest wastewater quantities than others.

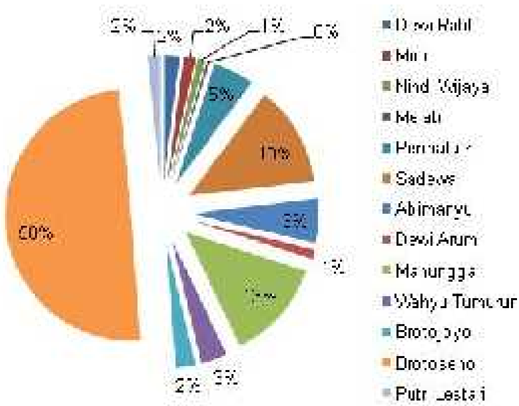

Figure 9 Wastewater quantities from 13 batik industries in Masaran Sragen

CONCLUSION

Two potential clusters are identified, they are furniture cluster in Sukoharjo and batik cluster in Sragen. Many of the references to determine and to calculate justification of these theories and formulas, yet no real utilization are established during observation.

The furniture cluster in Sukoharjo emits nearly 117 CO_2-eq tones/ year (electricity source) and 2.44 CO_2-eq tones/ year (dry kiln's fuel).Dry Kiln's heat loss estimation is 68 – 72 %. Potential dry kiln's energy saving 6 – 11 %. The batik cluster in Sragen :

a. Emits nearly (for cotton algodon/ mori) :
   6.92 CO_2-eq tonnes/ year (electricity source).
   144.83 CO_2-eq tonnes/ year (kerosene source).
   10.13 CO2-eq tones/ year (firewood source).

b. Emits nearly (for silk) :
   0.77 CO_2-eq tonnes/ year (electricity source).
   18.37 CO_2-eq tonnes/ year (kerosene source).
0.16 CO_2-eq tonnes/ year (firewood source).

REFERENCES

GIZ Indonesia, 2012, Baseline data Eco-Efisiensi PAKLIM GIZ for Industrial Cluster in Central Java Province : Masaran Batik and Bulakan Furniture, GIZ, Semarang.

Grisworld, John,1946, Fuels, Combustion and Furnaces; McGraw-Hill Book Company.Inc; New York, London.

Holman J.P,1988, Heat Transfer, Sixth Edition, Erlangga Press; Jakarta.

Tchobanoglous, George and Burton, Franklin,2003, Wastewater Engineering Handbook, McGraw-Hill Book Company.Inc, New York, London.

The Commonwealth of Australia, 2008, Technical Guideliness for the Measurement of GHG from National Greenhouse and Energy Reporting System Measurement, Sydney.
www.energyeficiencyasia.org/energy equipment/thermal
www.pelangi.or.id
www.planet-energy.blogspot.com
www.reuters.com/article envNews/idUSSAK26206220070604
www.uneptie.org/energy/act/ef/GHGin/2006

UTILIZATION SOIL MATERIALS AS POWER GENERATOR WITH STRUCTURE SELECTIVATION METHODE AND ELECTRODE POTENTIAL MATERIAL

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Abstract

Soil energy is one of renewable energy that will not depleted its availability in seeking local electrification needs can optimized. Sources of electrical energy use all types of soil material through electrochemical reactions, material execution and analysis of electrode structures, and electrolyte solutions. The electrochemical reaction uses potential of chemical energy into electrical energy using copper electrodes (Cu) as the positive terminal, zinc (Zn) as negative terminal, and water (H_2O) as electrolyte solution. The structure and material of the electrode is analyzed by the reaction of energy spontaneity with electrode reduction potential (E^o), voltaic series, and temperature reactivity to energy level (thermodynamics). In an electrochemical reaction, the copper reduces the copper (II) ions as well as releases 2^{e-} which will react to form a Cu solid. While zinc oxidizes to form zinc ions (II) and catch 2^{e-}. The surface area, thickness, and length of the conductor in the construction of the electrode material affect the ionization of the flowing material. The laying of two electrodes cross-sectionally uses a 3 layer conductor wall container through an external heating constituent system (thermodynamic process). This instrument is equipped with sensors and display displays integrated with minimum watering system.

keywords: electrochemistry, electrode, electrode reduction potential, conductor, minimum watering system

INTRODUCTION

The demand for electrical energy is increasingly unbalanced by the depletion of the availability of energy sources, the high use of raw materials of oil, the timing and operational costs of ineffective generation development, and the lack of public awareness of the optimization of renewable energy sources from the natural environment. The availability of energy in Indonesia is very abundant as geothermal by 40% of the world's geothermal, wind, solar cell, water (mykrohidro), sea water waves, optimized bioenergy.

Economic growth in Indonesia has decreased, which is influenced by the decrease of national petroleum production causing reduced revenue from oil and gas sector, weakening of rupiah exchange rate against US dollar, inflation increase, and demographic data has not changed much. Based on Presidential Regulation no. 5 of 2006 on National Energy Policy, Indonesia is still not optimal in mapping the potential of Renewable Energy (EBT). This is due to the high consumption of oil and gas energy. Based on research of petroleum reserves of 3.6 billion barrels, natural gas of 100.3 TCF, and coal reserves of 32.27 billion tons or based on R / P ratio (Reserve / Production) of petroleum depleted in 12 years, natural gas 37 year, and 70 years of coal. Fossil energy does have a greater energy power than the natural energy that is utilized by coal energy consumption of 50% (26 GW), natural gas 23% (12 GW), and oil 14% (7.5 GW). Indonesia also has a wealth of energy in national per capita electricity consumption although it is still well below the average per capita power consumption of Brunei Darussalam, Malaysia, Singapore and Thailand with an average of more than 2000 kWh / capita.

Soil energy is one of renewable energy that will not be depleted its availability to seek the energy needs of electrification. This electrical energy utilizes all types of soil material through electrochemical reactions, the investigation of potentially powerful electrode materials in generating electrical current, and the source of electrolyte availability in electrochemical reaction processes.

The process of utilizing electrical energy from chemical energy (voltaic cells) has been applied in a field of transportation for power supplies. In this case, the voltaic cell is applied in a larger number of power amplifiers. The electrodes used are copper (Cu), zinc (Zn), and water (H2O) as electrolyte solution. The selection of structures and electrode materials is calculated by the electrode reduction potential (Eo) and the voltaic series. The copper electrode (Cu) as the positive pole and the zinc electrode (Zn) as the negative pole. In the electrochemical reaction, the copper will undergo the process of reduction and zinc by oxidation process. Copper will reduce the copper (II) ions and simultaneously release 2e- which will react to form a solid Cu substance. While zinc oxidizes to form zinc ions (II) and catch 2e-. The movement of ions within the electrode surface will conduct a weak electric current so that the electrode structure's effectiveness in terms of surface area, thickness, and conductivity length should be considered.

The laying of two electrodes is cross-linked at a site with a 3-layer conductor wall to increase the rate of movement of the surface energy level of the electrode (thermodynamic process). This mechanism is equipped with a sensor and lcd display using a proximity sensor, temperature, and integrated with minimum watering system.

METHODOLOGY

The research method used has four stages, namely the stage of analysis, design, implementation, and testing. the analytical method is applied to reveal or encapsulate quantitative information according to the identification of the problem formulation. Problem analysis on the energy generation system has parameters in the electrode material's effectiveness analyzed on measurement of surface area, thickness, and length of conductor. This process is performed to obtain the current measurement data generated through current flow resistance. The electrode requirement specification is effected in the energy circuit through the electrochemical reaction system and electrode reduction potential (Eo) which determines the potential difference based on the standard reduction potential tables and voltaic series. The energy material transfer system in thermodynamics is measured through an external temperature change formulation to the change in the voltage flowing on the electrode.

The design stage is done by doing some collection of materials and tools as well as design concept or design of the system of energy generation. Here is a construction concept for electrical energy from the ground.

Implementation stage is the stage of design workmanship of the generation system of the process of combining materials and hardware components.

The testing stage is done by measuring the voltage and current on the tool that has been made as an indication of the success of the operation on the system. The test variables for this research are soil, electrolyte solution, and metal as electrodes.

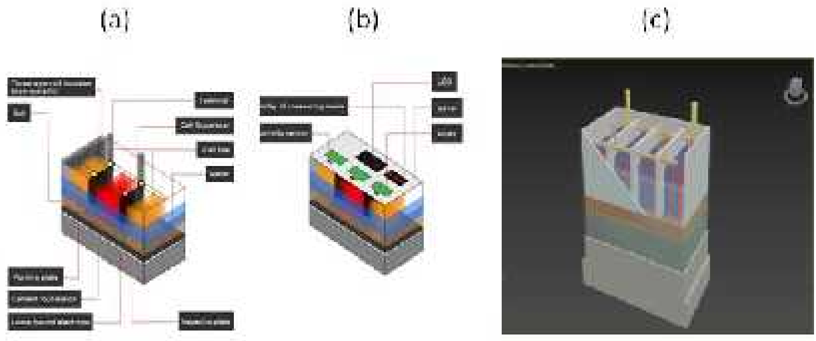

Figure 1 (a) dan (b) Construction inside and outside (2d), (c) snore design (3d)

RESULT AND DISCUSSION

In generating electrical energy from the ground using 2 electrodes, namely copper (Cu) and zinc (Zn). The process of strengthening the electrical energy delivered through the eletrode surface is produced by electrochemical reaction. Wrinkles the resulting reactions.

$$
\begin{aligned}
E^o_{\text{cell}} &= E^o_{\text{cathode}} - E^o_{\text{anode}} \\
&= E^o_{\text{reduction}} - E^o_{\text{oxidation}} \\
&= E^o_{(+)} - E^o_{(-)} \\
&= E^o_{\text{big}} - E^o_{\text{small}}
\end{aligned}
$$

E^o in reaction between copper electrode (Cu) with zinc (Zn)

$$
\begin{aligned}
E^o_{\text{cell}} &= E^o_{\text{cathode}} - E^o_{\text{anode}} \\
&= E^o_{\text{reduction}} - E^o_{\text{oxidation}} \\
&= E^o_{\text{copper}} - E^o_{\text{zinc}} \\
&= 0{,}337 - (-0{,}763) \\
&= 1{,}1 \text{ Volt}
\end{aligned}
$$

The redox reaction between copper electrodes (Cu) with zinc (Zn)

$$Zn\ (s) \rightarrow Zn^{2+}\ (aq) + 2e^- \quad \rightarrow \text{oxidation}$$

$$Cu^{2+}\ (aq) + 2e^- \rightarrow Cu\ (s) \quad \rightarrow \text{reduction}$$

$$Zn\ (s) + Cu^{2+}\ (aq) \rightarrow Zn^{2+}\ (aq) + Cu\ (s)$$

The cell diagram between copper electrode (Cu) with zinc (Zn)

$$Zn\ (s)\ |\ Zn^{2+}\ (aq)\ ||\ Cu^{2+}\ (aq)\ |\ Cu\ (s)$$

In the above reaction can be interpreted as follows.

- Chemical energy transforms into electrical energy
- Cathode: positive electrode (Cu metal) reduction reaction occurs
- Anode: negative electrode (metal Zn) occurs oxidation reaction

In addition to the previously used electrode, it can also use other metals such as iron (Fe), aluminum (Al), platinum (Pt), lithium (Li), magnesium (Mg), and many others (can be seen in table electrode potential) standard (Eo) .The electrolyte used is water (H2O) because the availability of the dialam is easier to obtain and the innovation of this renewable energy utilizes the local natural resources.The type of soil used is all kinds of soil only implementation of a slightly smoother soil texture and not unity.The soil capacity and volume of water affects the stability of the energy energy generated, the magnitude of current and voltage, the time interval of each occurrence of the decrease or increase of the power of electric power, and the magnitude of resistance in the process of conducting the ion in an electrode surface The soil in the form of slightly smoother texture and unbounded will facilitate the electrolyte (H2O) in receiving and releasing electrode ions so that the perpind cycle the energy and the flow of electrons as well as the wider chemical processes of the space medium which allow the barriers to become smaller.

The need of the electrode material itself affects the amount of current and the resulting voltage. Surely the electrode conductivity is viewed from the narrowness of the electrode surface, the object type constraints, the length of the conductor, the suitability of the water discharge, the soil capacity, and the number of electrodes used, the influence of temperature on the increase in energy. Electrode requirement analysis used is with the following calculation.

Material electrode and conductor Zn (length x width) = 23cm x 8cm
Cu (cylinder) = height (23cm), diameter (0,1cm)

Electrical Resistance :

$$(R) = \frac{\rho\ (\Omega m)\ L(m)}{A(m^2)}$$

$$R\ Zn = \frac{0{,}12 \times 23.10^{-2}}{23.10^{-2} \times 8.10^{-2}} = 1{,}5\ \Omega$$

$$R\ Cu = \frac{0{,}0175 \times 23.10^{-2}}{2 \times 3{,}14 \times 5.10^{-2} \times (5.10^{-2} + 23.10^{-2})} = 0{,}08792 \text{ ohm}$$

Condutor with Cu (cylinder) = height (23cm), diameter (0.05cm)

$$R\ Cu = \frac{0{,}0175 \times 16.10^{-2}}{2 \times 3{,}14 \times 25.10^{-3} \times (25.10^{-3} + 23.10^{-2})} = 0{,}10053 \text{ ohm}$$

In designing the system to generate such energy, made stages in the form of control system and construction of material to be made. Here the system development diagram to be built is as follows.

Based on Figure 2, the inputs are used using several components and materials as a trigger to generate new energy, ie the material in the form of soil as the main source of energy to be generated, the electrode in the form of copper (Cu) and zinc (Zn) respectively as positive and negative terminals, electrolyte solutions of water (H2O) as catalysts for generating electrical energy from chemical energy through a series of reactions to flow and deliver electrode ions through the dynamics of energy levels triggered by external heating systems, and sensors used as tools or hardware component as an electronic instrument to record and display information.

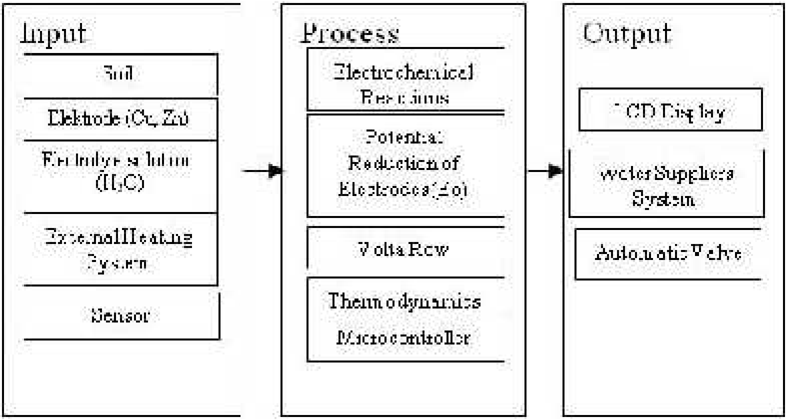

Figure 2 Block Diagram of Development of Electrical Energy Generation System from Soil

The process step here applies a number of reactions that conceptually base on mechanisms to generate energy through electrochemical reactions as a reaction to change Electrical Motion energy), voltaic series as the determination of spontaneous reaction to an electrode cell from cell difference difference, thermodynamics as an electrolyte solution, physics separates the two reactants and also prevents electronic conduction, as long as ionic ions carry electrons through an external circuit to provide charge, the microcontroller used by the intelligent brain to control the system automatically.

At the output stage used hardware components such as 16x2 LCD display, automatic valve, and minimum system water supply that operates based on instructions from the sensor used (distance).

Flowcharts made in the manufacture of renewable energy systems from soil materials can be seen in Figure 3. Chemistry into electrical energy, electrode reduction potential (E^0) as a cell system having parameters based on standard electrode potentials defined as DGL.

Based on the picture above, the microcontroller is started by giving 5V power supply and start running program execution to activate relay module which connect directly with AC power. From the program it will enable the external heating system to react and increase the energy level of the system. When the temperature has reached the limit setting program, it will move the relay to turn off the heating system automatically through microcontroller programming.

From the heating reaction, the water volume will decrease as electrolyte solution so that in this system is equipped with proximity sensor to detect the problem. when the water volume limit does not match the specified limit (decreases), the program will execute to activate and control the water pipeline. If the water condition has reached a certain height limit (according to the distance sensor input), then the operation for the water channel will be turned off. Automated operated control systems are used to improve and maintain current and voltage stability resulting from external heating systems.

Each material (material) has energy with a certain level. One way to supply energy to a material is by heating. If the metal is heated it will form local corrosion cells and the hotter parts will react first. The more corrosion cells the easier it will be to release electrons or more easily oxidize. Thus the oxidation potential is increased or more easily oxidized.

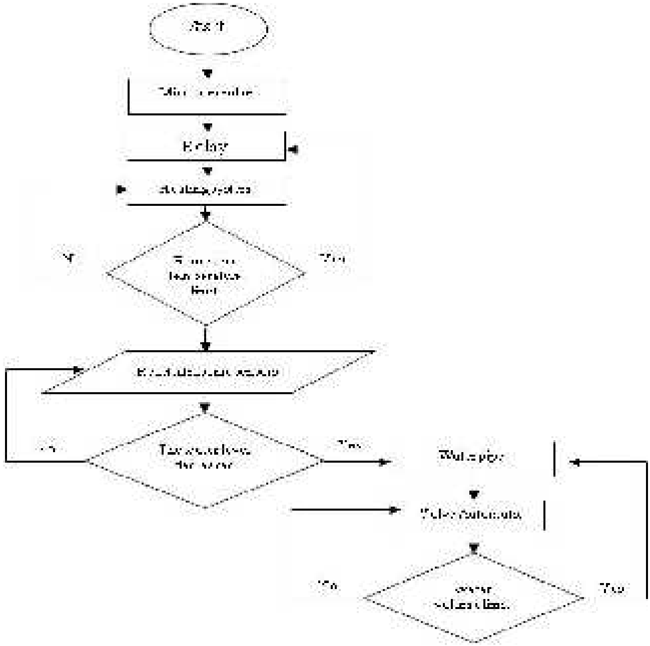

Figure 3 Flowchart Development of Electrical Energy System from Soil

The influence of temperature on the energy level based on the Galvani cell principle consists of two electrodes ie cathode and anode. An electrode has a certain potential called the electrode potential. The potential difference between the two electrons can be determined from the voltmeter. This shows that there is a difference in the energy of the two electrodes because the heat energy has changed into electrical energy. From the direction of the movement of the electron can be known metal high energy, high or low temperatures.

This event occurs when an electric current is passed through the compound and the compound undergoes a chemical reaction. electrolyte solution can conduct electricity because it contains ions that can move freely. The ions can conduct an electric current through the solution. The higher the temperature level, the higher the energy. If the temperature is raised, the energy in the molecules will increase so that more molecules reach the energy activation. Thus, the reaction proceeds more quickly. The increase in temperature also causes the molecules to move faster. Thus, matter contains energy, a certain level (amount), and has high and low energy levels.

CONCLUSION

Electricity power generation from the soil is utilized to be a more complex and productive form in order to increase the added value in the utilization of local natural resources by mechanization of electrochemical processes, the execution of structures and electrode materials, the volume of electrolyte solutions, and the need for soil capacity. The transformation of renewable natural energy into electrical energy considers the duration of utilization, stability and energy security, availability of energy source materials, operational costs, and the level of demand for environmentally friendly energy.

In this research, careful scrutiny and method of analysis is needed because changing the form of energy is a common thing to do, but the optimization of energy availability can not yet be implemented. In addition, operational costs and prototype production also need to be balanced to smooth the process of research gradually and periodically.

REFERENCE

Atkins. 2005. *Physical Chemistry*. Oxford: Oxford University Press.

BP. 2016. *BP Energy Outlook 2016 edition*. BP p.l.c.. London.BPPT. 2015. *Outlook Energi Indonesia 2015*. Badan Pengkajian dan Penerapan Teknologi. Jakarta.

Dogra.2008. *Kimia Fisika*. Jakarta: UI

ExxonMobil. 2016. *The Outlook for Energy: A View to 2040*. Exxon Mobil. Texas.

IEEJ. 2015. *Asia/World Energy Outlook*. The Institute of Energy Economics, Japan, Tokyo.

Oxtoby, David W , dkk.1999.*Prinsip-Prinsip Kimia Modern Edisi Ke-empat* . Jakarta :Erlangga.

Rajic, ljiljana, Bozo Dalmacija, Svetlana dan Milos Bokorov. 2012. *Electrokinetic Treatment of Cu Contaminated Kaolin Using an Fe/Cu Galvanic Cell.* International Journal of Electrochemical Science Vol. 7.

Syukri. 1999. *Kimia Dasar*. Bandung: Penerbit ITB.

SWOT ANALYSIS AS STRATEGIC TOOLS FOR SMALL BUSINESS ENTERPRISE (SME) DEVELOPMENT IN MATARAM CITY

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ABSTRACT

This study was conducted on the basis of the interesting fact that SMEs have high resistance in economic crisis, absorb more labor, and open up new job opportunities. This paper reviewed the condition of SMEs in Mataram (province of west nusa tenggara) and efforts SME empowerment done by the Government of Mataram as well as what factors affect the development of SMEs in Mataram. This research used qualitative method as research method in order to dig deeper phenomenon that occurs, supported by data that has been validated the truth. Sourced of this research are from the government office in Mataram that is attached along with the competent staff in the field, then triangulated data and then crosscheck the truth through interviews with business actors SMEs themselves. This research found, in general, it has been known that special attention is needed in some aspects as an effort to develop SMEs in the future. These aspects are aspects of management, financial aspects, aspects of infrastructure, environmental aspects, and aspects of human resources. This aspect of human resources should be included in the priorities of SME training and coaching activities. Because without a reliable HRM SMEs will be difficult to develop. The government is also still lacking in conducting coaching due to cost constraints and minimal coordination among related agencies. Keywords: empowerment, small and medium enterprises, labor.

PENDAHULUAN

Latar Belakang

Usaha Kecil Menengah (UKM) di Indonesia tumbuh subur karena jenis usaha dengan skala ini begitu kuat dan tahan terhadap kondisi krisis yang beberapa kali melanda di negara ini. Selain itu UKM terbukti mampu menyerap tenaga kerja yang cukup signifikan untuk mengatasi permasalahan pengangguran yang juga saat ini menjadi permasalahan serius. Pemerintah sebenarnya telah mengupayakan berbagai jalan keluar untuk mengatasi pengangguran secara bertahap baik di perkotaan maupun di pedesaan akan tetap hasil nya belum cukup memuaskan dan perkembangannya tidak cukup menggembirakan.

World bank mencatat peningkatan angka pengangguran di Indonesia, dari 8,1% dari total angkatan kerja pada bulan November 2010 menjadi 8,5% di tahun 2010, atau sekitar 8 juta orang. Angka tersebut belum mencakup lebih dari 30 juta orang yang termasuk dalam kategori pengangguran tertutup. Pada kondisi seperti ini Usaha Kecil Menengah (UKM) kemudian akhirnya menjadi pilihan bagi masyarakat Indonesia.

Kota Mataram merupakan kota yang tingkat pengangguranya cukup memprihatinkan padahal di satu sisi pertumbuhan UKM di kota ini secara kuantitatif . Salah satu hal yang mungkin bisa dijadikan solusi dari pengangguran dan perluasan kesempatan kerja adalah dengan mengembangkan sektor UKM. Pemerintah sebagai salah satu pihak yang memiliki kekuasaan untuk membuat suatu kebijakan diharapkan bisa mendukung penuh pertumbuhan UKM dengan meningkatkan perannya dalam memberdayakan UKM disamping mengembangkan kemitraan saling menguntungkan antara pengusaha besar dengan pengusaha kecil, selain itu peningkatan kualitas sumber daya manusia yang dimiliki menjadi salah satu pekerjaan rumah yang harus dikerjakan agar kedepannya sektor ini dapat bersaing di era globalisasi.

Belum adanya analisa mendalam menjadi permasalahan tersendiri dalam mengembangkan UKM di kota Mataram. Selain itu faktor sumber daya manusia (SDM) yang terbatas juga menjadi sebuah kendala sehingga perkembangan UKM menjadi belum optimal, Iklim usaha belum sepenuhnya kondusif turut serta menyumbang lambatnya perkembangan UKM di Indonesia. Kurangnya permodalan, dan terbatasnya sarana dan prasarana usaha merupakan factor lain juga yang perlu mendapat perhatian khusus.

Bertolak dari fenomena di atas kiranya sangat menarik untuk dilakukan penelitian dengan menggali data secara mendalam kemudian melakukan analisis SWOT sebagai output bagi pemerintah Kota Mataram untuk penerapan strategi pengembangan usaha kecil menengah (UKM), sebab untuk mengetahui Penelitian ini juga akan menjadi sebuah bahan untuk melihat lebih jelas mengenai bagaimana kondisi pengembangan usaha kecil dan menengah di kota mataram dan melihat peran serta pemerintah daerah dalam mengembangkan UKM di kota Mataram.

METODOLOGI

Metode Penelitian

Penelitian ini mengunakan metode penelitian kualitatif dengan lokasi penelitian di kota Mataram yaitu kantor Dinas koperasi dan usaha kecil menengah (UKM) kota mataram dan kantor Dinas perindustrian dan perdagangan (Deperindag) kota mataram. Adapun responden dalam penelitian ini adalah (1) Kassubag dan staff dinas koperasi dan UKM kota mataram (2) Kepala dinas disperindag mataram (3) Pelaku UKM Kota Mataram.

Analisis Data

Data yang telah terkumpul sebelum diinterpretasikan, terlebih dahulu memerlukan pemerosesan, yaitu dilakukan dengan melakukan analisa data. Tujuan dari analisa data dalam penelitian adalah menyempitkan dan membatasi penemuan - penemuan hingga menjadi suata data yang teratur, serta tersusun dan lebih berarti dengan melakukan reduksi data, penyajian data, dan penarikan kesimpulan atau verifikasi

HASIL DAN PEMBAHASAN

"Kondisi UKM di kota mataram, sama saja dengan kondisi UKM di kota kota lain" kata kepala bidang perdagangan dinas Koperasi Perindustrian dan Perdagangan (Diskoperindag) Kota Mataram Uun Pujianto, Ia juga mengungkapkan bahwa UKM Kita kondisinya sebagian besar tidak dikelola secara professional, tanpa manajmen yang jelas dan hanya sekedar untuk menghidupi keluarga, padahal jumlah UKM yang terdata saat ini adalah cukup besar yaitu sejumlah 1256 UKM. Seperti terlihat pada tabel berikut.

Tabel 1. Kondisi UKM Kota Mataram menurut Kecamatan

No	Kecamatan	Jumlah UKM
1.	Mataram	301
2.	Ampenan	257
3.	Cakra Negara	228
4.	Sandubaya	213
5	Sekarbela	106
6	Selaparang	178
	Jumlah	**1256**

Sumber: data survey Deperindag,kota mataram

Dari tabel 4.1 bahwa kecamatan Mataram memiliki jumlah UKM paling banyak yaitu 301 UKM, dan dari hasil penelitian pelaku UKM Kota mataram sebagian besar memiliki tingkat pendidikan yang rendah. Disinilah peran pemerintah mendongkrak kreativitas yang dimiliki oleh pengusaha kecil ini untuk dapat menggali kemampuan dirinya agar mampu bersaing dalam kancah perniagaan di negeri ini. Kepala dinas Deperindag Kota Mataram memberikan data kepada kami yang menunjukkan bahwa pemerintah memang masih kurang dalam melakukan pembinaan UKM karena terkait anggaran yang tersedia masih minim dan kurangya kordinasi antara pelaksana kebijakan yang saling berhubungan. Dari data yang ada hanya 16,61

% yang telah dibina, sedangkan 83,39% UKM belum pernah mendapatkan pembinaan. Seperti terlihat pada tabel berikut.

Tabel 2. Pembinaan UKM Oleh Disperindag di Kota Mataram

Pembinaan Oleh Instansi Terkait	Jumlah	%
Dibina	50	16,61
Tidak dibina	251	83,39
Jumlah	**301**	**100,00**

Sumber: data survey deperindag,kota mataram

Kemudian terkait mengenai pendanaan, penulis coba menelusuri lebih jauh lagi dan kemudian melakukan cross chek kepada para pelaku usaha dan dari salah satu pelaku usaha kecil menengah di Kota Mataram yang bergerak di usaha pembuatan tahu, amaq said (pelaku usaha tahu) mengungkapkan bahwa : saya tidak pernah di datangi oleh dinas untuk ditawarkan pelatihan, saya bersama anak dan istri hanya usaha sendiri saja, “ga” pernah di latih atau diperhatikan kebutuhannya. Lebih lanjut dia mengatakan bahwa mereka kurang dana kemudian mencoba mengusahakan pendanaan dari pihak bank melalui kredit usaha rakyat juga masih kesulitan untuk di setujui. Penulis menemukan memang hal ini merupakan permasalahan yang umum terjadi karena administrasi keuangan UKM dengan skala kecil masih kurang rapi sehingga pihak pemberi pinjaman seperti Bank juga masih ragu untuk memberikan pinjaman dana.

Sebagian besar pengusaha kecil menggunakan modal seadanya yang mereka miliki, dan setelah usaha berjalan sekian lama, mereka berusaha mencari tambahan modal. Faktor ketersediaan modal usaha nampaknya merupakan kendala utama dalam kegiatan UKM, namun persoalan tersebut dapat diatasi antara lain dengan cara menggunakan sebagian pendapatan dari kegiatan usaha yang lain. Sedangkan bantuan permodalan dari pemerintah, bank, dan instansi terkait lainnya terhadap UKM belum banyak dirasakan oleh pengusaha seperti yang telah diungkapkan responden diatas.

Selanjutnya penulis kembali mencari data mengenai jenis pendanaan para pelaku UKM ini dan menemukan bahwa pendanaan UKM yang terbesar berasal dari dana pribadi yaitu 93.69%, sedangkan pemerintah masih berada pada porsi terendah yaitu hanya 1.33%.

Tabel 3. Jenis Pendanaan UKM Kota Mataram

Pendanaan	Jumlah	%
Pribadi	282	93,69
Bantuan bank dan pribadi	15	4,98
Bantuan pemerintah dan pribadi	4	1,33
Total	**301**	**100,00**

Sumber:data survey deperindag,kota mataram

Kondisi lain yang menjadi point penting dalam pengembangan UKM adalah aspek produksi , karena hal ini memberikan dampak yang cukup besar dalam pengembangan UKM. Aspek produksi dalam UKM meliputi teknologi, volume produksi, biaya produksi dan bahan baku.

Teknologi

Pada umumnya UKM masih tradisional dalam penggunaan teknologi. Padahal seorang pengusaha harus jeli menangkap peluang pasar dan tentunya harus selalu tanggap dengan kemajuan teknologi yang ada agar tidak ketinggalan dengan perusahaan lain, sehingga mempengaruhi usahanya, baik efisiensi maupun pemasaran. Adapun teknologi yang kreatif bagi seorang pengusaha bisa mendorong munculnya produk-produk baru sebagai pembaharuan dari produk-produk yang telah ada, sehingga diharapkan konsumen tidak merasa jenuh dengan produk yang dikonsumsinya. Data yang didapatkan penulis adalah bahwa pelaku usaha UKM masih banyak yang menggunakan teknologi sederhana dalam menjalankan usaha UKM nya.

Tabel 4. Penggunaan Teknologi UKM Kota Mataram

Penggunaan tekhnologi	Jumlah	%
Tradisional	123	40,86
Modern	66	21,93
Semi modern	112	37,21
Total	**301**	**100,00**

Sumber:data survey

Volume Produksi

Volume produksi UKM sebagian besar masih tergantung pada pesanan, sedangkan sebuah usaha yang berproduksi dengan hanya mengandalkan pesanan akan sulit berkembang dan bersaing dengan usaha lain yang memproduksi dan langsung dipasarkan tanpa menunggu pesanan, tentu saja hal ini didasarkan pada analisis yang mendalam.

Biaya Produksi

Biaya produksi dan bahan baku yang dibutuhkan dalam suatu proses produksi tergantung pada besarnya volume produksi. Jumlah tenaga kerja pada UKM, seperti halnya aspek produksi, jumlahnya tidak tetap tergantung pada banyak sedikitnya pesanan, bila pesanan banyak maka tenaga kerja pun juga akan bertambah, sehingga pada UKM ini berlaku pekerja tetap dan pekerja borongan.

Bahan Baku

Keterbatasan bahan baku sering menjadi kendala pertumbuhan dan kelangsungan produksi bagi sebagian besar UKM di Kota Mataram. Demikian juga masalah harga yang seringkali mengalami kenaikan. Artinya kemudahan dalam mendapatkan bahan baku dan faktor harga adalah faktor utama bagi setiap kegiatan usaha. Semakin mudah dan murah suatu usaha untuk mendapatkan bahan baku, maka akan semakin murah keluaran produk yang dihasilkan.

Faktor akhir yang berusaha di telusuri adalah melihat aspek pemasaran usaha UKM ini, karena bagaimanapun juga aspek pemasaran adalah salah satu aspek yang sangat berpengaruh dalam perkembangan dunia usaha disamping aspek produksi.

Pada umumnya UKM hanya memiliki lingkup daerah pemasaran yang sempit, yaitu daerah pemasaran dalam dan luar kota. Pemasaran ekspor belum menjadi sasaran utama. Kondisi UKM di Kota mataram saat ini masih jauh dari kata ideal. pemasaran UKM dengan prosentase tertinggi adalah dalam dan luar kota yaitu 59.47%, sedangkan 0.33% UKM daerah pemasarannya dalam kota, luar kota, dan ekspor yang merupakan daerah pemasaran dengan prosentase terrendah.

Tabel 5. Distribusi pemasaran pelaku UKM Kota Mataram

Daerah pemasaran	Jumlah	%
Dalam kota	102	33,89
Dalam dan luar kota	170	59,47
Dalam luar dan ekspor	5	1,66
Luar kota	14	4,65
Luar kota dan ekspor	1	0,33
Total	**301**	**100,00**

Sumber data survey

Untuk kegiatan promosi nya juga masih sangat sederhana, yaitu masih menggunakan model promosi tradisional tampak pada table 6.

Tabel 6. Jenis Promosi Pelaku Usaha UKM Kota Mataram

Jenis promosi	Jumlah	%
Kartu nama	38	12,63
Pameran	15	4,99
Brosur	3	1,00
Spanduk	1	0,33
Koran	3	1,00
Iklan	2	0,66
Leaflet	3	1,00
Kalender	1	0,33
Sales	4	1,33
Label	2	0,66
TV/radio	2	0,66
Yellow pages	1	0,33
Papan nama	1	0,33
Sponsorship	1	0,33
Pameran dan kartu nama	3	1,00
Took/counter	2	0.66
Brosur dan pameran	1	0,33
Total	**301**	**100,00**

Sumber data survey 2008/2010

Analisis SWOT

Dari hasil wawancara, observasi, dan dokumentasi yang dilakukan oleh penulis sebelumnya sehingga penulis berhasil menyusun sebuah analisis SWOT yang digunakan untuk mengidentifikasi permasalahan, kebutuhan dan potensi usaha kecil dan menengah (UKM) yang ada di kota mataram. Analisis ini bertujuan untuk mengidentifikasi suatu kegiatan usaha secara sistematis dan menyeluruh yang meliputi aspek produksi, permodalan, tenaga kerja, dan pemasaran.

1. Aspek Usaha

UMUM	KEKUATAN	KELEMAHAN	PELUANG	ANCAMAN
bentuk kelem-bagaan	Hubungan interpersonal yang sangat erat	Tidak Memiliki bentuk Kelembagaan Dan Struktur organisasi yang jelas	Ketika produksi dan pemasaran semakin besar, struktur organisasi yang jelas sangat di butuhkan	Tidak jelasnya pembagian tugas dan wewenang, sehingga hub, antara pekerja dan pengusaha menjadi rusak.
Pembinaan oleh instansi terkait	Kebijakan kebijakan baik dari pemerintah pusat sampai pemerintah daerah tentang UKM	Terbatasnya akses dan kemudahan program pelatihan bagi pekerja dan pengusaha	Instansi terkait sudah memberikan perhatian untuk melakukan pembinaan terhadap UKM	Belum adanya kepastian hukum yang merupakan perlindungan bagi UKM yang dipatuhi oleh semua pihak
Tenaga kerja	1. Banyak menyerap tenaga kerja karena tidak adanya pemabatasan usia pegawai. 2.pemahaman tenaga kerja tentang produk pada umumnya bagus	1. Tingkat pendidikan tenaga kerja rendah. 2. tidak adanya pengemabangan terhadap tenaga kerja seperti pengembangan kepribadian, cara produksi, keuangan, dll.	Bisa dikembangkan UKM yang bisa menyerap tenaga kerja yang lebih banyak	System penggajian yang kurang baik akan menyebabkan proses produksi tidak maksimal
Pendanaan	1. Dalam melakukan usaha	1. Tidak memiliki administrasi	1. Lembaga keuangan berpeluan menjalin	1. modal yang tidak cukup bisa mengancam

	umumnya UKM menggunakan modal sendiri. 2. Modal bukan kendala utama dalam UKM	keuangan yang baik. 2. Kurangnya informasi sumber kredit	kerja sama degan UKM dalam bentuk Kredit Usaha Kecil. 2. Kebijakan pemerintah yang berpihak pada UKM.	kestabilan usaha karena tidak memenuhi target. 2.pengelolaan keuangan yang kurang baik akan menyebabkan perusahaan gulung tikar

2. **Aspek produksi**

	KEKUATAN	KELEMAHAN	PELUANG	ANCAMAN
Teknologi	Teknologi yang digunakan dalam proses produksi masih sangat sederhana	Kuantitas dan kualitas produk belum optimal	Pengenalan teknologi produksi sangat di butuhkan	Kualitas dan kuntitas yang belum optimal menyebabkan kalah bersaing dengan perusahaan lain
volume produksi	UKM mampu meningkatkan volume produksi bila diperlukan	Volume produksi tergantung pada pesanan	Volume produksi masih bisa ditingkatkan	Pemasaran yang tidak baik sehingga barang tidak laku

3. **Aspek pemasaran**

	KEKUATAN	KELEMAHAN	PELUANG	ANCAMAN
Daerah pemasaran	Pelaku UKM siap memasarkan produknya kemana saja	Lingkup daerah pemasaran sempit	Peluang pasar sangat luas	Tidak adanya bantuan pemerintah pusat/ daerah untuk membuka daerah pemasaran yang lebih luas
Segmen pasar	Segmen pasarnya untuk menengah	Kurang bagusnya kemasan dan	Memperbaiki kemasan dan meluncurkan harga	Banyaknya produk impor yang bagus dan murah

	kebawah dan keatas	harga yang tidak kompetitif	yang kompetitif dengan pasar	
Teknik pemasaran	Mekanisme penjualan sebagian besar UKM dilkukan ditempat produksin, artinya UKM sudah mampu menarik pembeli ketempat mereka	1. teknik pemasaran sebagian besar secara langsung melalui pesanan. 2. system penjualan umumnya masih incidental, artinya UKM lebih banyak menunggu pembeli	Melakukan identifikasi pasar dan prilaku konsumen	Semakin banyaknya usaha sejenis merupakan ancaman yang serius bagi UKM lainya
Volume pemasaran	Ada keseimbangan antara permintaan pasar dengan kemampuan produksi	Volume pemasaran tergantung pada pesanan	Pembentukan kelemabagaan distribusi oleh UKM/ koperasi/ organisasi bisnis	Order yang sedikit bisa mengancam kestabilan usaha karena tidak bisa memenuhi target produksi
Rencana pasar yang dibidik	Adanya keinginan yang kuat dari pengusaha UKM untuk membuka pasar seluas-luasnya	Kurangnya informasi pasar	Pasar luar kota dan ekspor merupakan peluang pasar yang potensial	Dikhawatirkan usaha yang ada akan kalah bersaing dengan UKM di daerah lain yang mana pemerintah daerahnya telah memiliki database pusat-

				pusat informasi dan jaringan pasar sampai keluar negeri
f.jenis promosi	Adanya inovasi-inovasi baru dalam teknik promosi seperti lewat koran, radio, kartu nama, dsb	Banyak pengusaha kecil yang mengelola pemasaran usahanya dengan mengandalkan kebiasaan-kebiasaan yang telah berlaku saja dan belum banyak yang melakukan promosi	Promosi dikoordinir oleh pemerintah daerah dengan melalui website brosur, pameran atau buku, dll	Mutu/ kualitas produk di awash standard an tidak sesuai dengan promosi
Jaringan distribusi	Sebagian keci UKM sudah memiliki jaringan distribusi	Banyak yang tidak mempunyai jaringan distribusi	Jenis pembeli produk UKM bervariasi mulai dari tengkulak distributor maupun konsumen langsung	Jenis pembeli produk UKM bervariasi mulai dari tengkulak, distributor maupun konsumen langsung

Upaya Pemberdayaan Usaha Kecil Dan Menengah (UKM) Yang Dilakukan Pemerintah Kota Mataram

Pengembangan Usaha Kecil dan Menengah diharapkan dapat memberikan kontribusi yang besar terhadap proses pemulihan perekonomian nasional, sehingga perlu lebih diperhatikan karena mengemban misi menciptakan pemerataan kesempatan kerja dan berusaha melestarikan budaya dan mendukung eksspornasional. Terdapat dua prioritas dalam pengembangan Usaha Kecil dan Menengah (UKM)yaitu Prioritas Jangka Pendek, diberikan untuk mempercepat penyelesaian utang Usaha Kecil dan Menengah serta meningkatkan aksesnya pada permodalan. Prioritas Jangka Menengah diarahkan untuk meningkatkan akses Usaha Kecil dan Menengah pada sumber daya produktif dan mengembangkan kewirausahaan.

Dari data diketahui bahwa Usaha Kecil dan Menengah (UKM) pada umumnya tersebar di sentra-sentra maupun di luar sentra yang diusahakan secara turun temurun dan proses terbentuknya merupakan bagian dari kultur masyarakat setempat. Usaha Kecil dan Menengah yang berkembang mampu berperan sebagai inti dan sekaligus sebagai penggerak pertumbuhan ekonomi desa/ kelurahan sehingga secara alamiah terjadi proses transformasi budaya dari masyarakat tradisional menuju masyarakat yang maju dan modern. Lebih jauh akan memberikan dampak yang besar pada peningkatan pendapatan masyarakat.

Peran Usaha Kecil dan Menengah (UKM) sering dikaitkan dengan upaya pemerintah untuk mengurangi angka pengangguran, memerangi kemiskinan dan pemerataan pendapatan daerah. Karena itu tidaklah mengherankan jika kebijakan pengembangan Usaha Kecil dan Menengah di Indonesia sering dianggap secara tidak langsung sebagai kebijakan penciptaan lapangan kerja atau kebijakan redistribusi pendapatan.

Dengan diberlakukannya otonomi daerah, UKM di Kota Mataram akan menghadapi perubahan besar yang sangat berpengaruh terhadap iklim usaha di daerah. Oleh sebab itu, setiap pengusaha UKM yang ada di Kota Mataram dituntut dapat beradaptasi untuk menyesuaikan diri menghadapi perubahan besar tersebut. Di sisi lain banyak Usaha Kecil dan Menengah didirikan, dan ternyata sebagian besar menemui kebuntuan, macet, bahkan gagal. Banyak Usaha Kecil dan Menengah yang mulanya sukses, justru macet ketika beranjak besar. Kebanyakan kegagalan ini diakibatkan karena lemahnya dalam pengelolaan Selama ini pembinaan dan pengembangan Usaha Kecil dan Menengah dilakukan dengan melibatkan pihak luar atau pihak*Non-Government* yang mempunyai kepedulian terhadap perkembangan Usaha Kecil dan Menengah, seperti Bank, baik bank pemerintah maupun bank swasta. Lembaga Keuangan bukan Bank (BUKOPIN), dan Bank Dunia.

a. *Upaya Pembinaan Dan Pengembangan Yang Dilakukan Oleh Dinas Perindustrian, Perdagangan Dan Koperasi (Disperindagkop) Kota Mataram*

Dalam wawancara terstruktur dengan Kepala Seksi Usaha Kecil dan Menengah, Dinas Perindustrian, Perdagangan dan Koperasi (Disperindagkop) Kota Mataram, Bpk. Hery Santoso, pada tanggal 07 Januari 2015, pkl 10.00 WIB, bahwa Seksi Usaha Kecil dan Menengah mempunyai tugas melakukan pemberdayaan dan pengembangan Usaha Kecil dan Menengah. Dalam melakukan tugas dan tanggung jawab tersebut, Seksi Usaha Kecil dan Menengah telah menetapkan tahapan atau langkah-langkahtindakan yang harus dilakukan dalam upaya pemberdayaan Usaha Kecil dan Menengah. Tahapan-tahapan tersebut adalah:

1. Pengumpulan, pengolahan dan penyajian data sebagai bahan pemberdayaan dan pengembangan Usaha Kecil dan Menengah (UKM);

2. Penyiapan bimbingan dalam rangka penyelenggaraan usaha UKM di bidang kelembagaan, pembiayaan, jaringan usaha, dan pengembangan sumber daya manusia;
3. Penyuluhan dan bimbingan teknis kewirausahaan dan kemitraan; 4. Pelaksanaan bimbingan pedoman akuntansi UKM;
4. Pelaksanaan fasilitasi permodalan UKM;
5. Pelaksanaan fasilitasi kemitraan UKM;
6. Pembinaan dan pengawasan penyelenggaraan UKM;
7. Pelaksanaan program pengembangan jaringan sistem informasi UKM;
8. Penetapan unggulan dan kinerja UKM;
9. Pelaksanaan advokasi terhadap UKM;
10. Pelaksanaan pengembangan sentra UKM;
11. Pelaksanaan stratifikasi terhadap UKM;
12. Pengevaluasian dan pelaporan pelaksanaan tugas dan fungsi;
13. Pelaksanaan tugas-tugas lain yang diberikan oleh Kepala Dinas sesuai dengan bidang tugas dan fungsinya.

Sedangkan upaya teknis yang dilakukan oleh Seksi Usaha Kecil dan Menengah adalah dengan mengadakan kerjasama dengan paguyuban. Paguyuban terdapatpada sentra-sentra industri yang mempunyai jenis usaha yang sama. Dan usaha tersebut sudah terdaftar pada Disperindagkop atau masuk dalam stratifikasi UKM. Jadi pengembangan dan pelatihan yang dilakukan oleh Disperindagkop tidak secara langsung kepada satu persatu unit usaha UKM, tetapi secara kolektif dilakukan melalui paguyuban. Hal ini dikarenakan keterbatasan anggaran dan tenaga penyuluh. Sedangkan untuk unit usaha UKM yang mempunyai prospek pasar yang baik tetapi tidak mempunyai wadah atau paguyuban, maka Disperindagkop secara langsung mendukung pelaku UKM tersebut untuk diberikan pelatihan.

Kegiatan rutin pelatihan dilakukan 6 sampai 7 kali dalam satu tahun.Kegiatan tersebut berupa pelatihan dan pengembangan produk meliputi bahan baku, proses produksi, variasi kemasan produk, *quality control* dan pemberian merk dagang. Disperindagkop juga memberikan fasilitas untuk pemasaran produk melalui berbagai event pameran baik yang diselenggarakan di dalam negeri maupun di luar negeri. Dengan menetapkan standar khusus terhadap produk yang mempunyai kualitas ekspor untuk produk yang akan dipamerkan di luar negeri. Pembukaan pasar di luar negeri dilakukan dengan bekerjasama dengan Menteri Luar Negeri. Disperindagkop juga melakukan beberapa kegiatan pemantauan terhadap UKM yang telah mengikuti pelatihan dan pengembangan yaitu:

1. Mengevaluasi sejauh mana peserta pelatihan mampu menyerap materi yang diberikan dalam pelatihan,
2. Mengikuti Bagaimana perkembangan usaha yang dikelola oleh peserta pelatihan,
3. Memberi penawaran apa peserta berminat untuk membuka usaha baru, jika materi pelatihan yang diberikan berkaitan dengan produk baru.

SIMPULAN

Dari analisa terhadap jenis temuan dilapangan pada penelitian ini, maka ada beberapa hal yang bisa disimpilkan antara lain:

1. Pemerintah masih perlu melakukan upaya serius dan lebih *massive* lagi untuk pengembangan UKM Kota Mataram
2. Faktor-faktor yang berpengaruh dalam pengembangan UKM di Kota Mataram meliputi aspek manajemen, aspek lingkungan, aspek infrastruktur, aspek produksi, aspek pemasaran, aspek keuangan, dan aspek sumber daya manusia. Pelaku UKM harus memiliki pengetahuan yang cukup tentang ketujuh aspek tersebut, agar usaha yang

mereka kelola mampu berkembang dan bersaing dengan usaha lain.

3. Kendala utama pemerintah dalam melaksanakan pembinaan UKM adalah pada masalah anggaran. Pemerintah menggantungkan semua kebutuhan anggaran pada APBD, sehingga program-program pelatihan dan pembinaan harus disesuaikan dengan kemampuan pendanaan pemerintah.

DAFTAR PUSTAKA

Anoraga dan Djoko Sudantoko, 2007 Koperasi, Kewirausahaan dan Usaha Kecil, Jakarta : Rienaka Cipta.

Badan Pusat Statistik Kota Mataram 2012

Badan Pusat Statistik Provinsi NTB 2012

Badan Pusat Statistik Indonesia 2012

Hafsaha, Muhammad Jaffar. (2004) Upaya pemberdayaan usaha kecil dan menengah. Infokop, Nomor 25 Tahun XXX 40 44

Iwan T dan Ahmad Erani Y, 2003, Emansipasi Nilai Lokal dan Ekonomi Bisnis Pasca Sentralisasi Pembangunan Jakarta; Bayumedia

Kertasasmita, ginanjar 1995. Perencanaan pembangunan nasional, Mataram :Universitas Brawijaya.

Nasirin, Chairun dan Alamsyah. Pemberdayaan Masyarakat dalam perspektif good governance. Mataram ; Indo Press

Rencana Strategis kementrian koperasi dan UKM Republik Indonesia tahun 2009-2014

Rencana Strategis dinas koperasi dan UKM Kota Mataram tahun 2009-2014

Sugiyono. (2013) Metode penelitian kualitatif dan kuantitatif R&D ; Bandung. Alfabeta

Undang – undang Republik Indonesia No. 20 Tahun 2008 tentang usaha kecil dan menengah

SATISFACTORY SURVEY ANALYSIS IN IPB VOCATIONAL SCHOOL USING IMPORTANCE PERFORMANCE ANALYSIS (IPA)

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ABSTRACT

IPB Vocational School is an institution of education service providers that provide services to students as users. Service quality needs to be improved to satisfy customers. One way to improve the service is to conduct a satisfaction survey. Student satisfaction survey in Diploma Program IPB conducted by Discipline and Student Commission. This survey is conducted every year. The 2014 survey form consists of 18 questions divided into two aspects. These aspects are academic (10 questions) and facilities (8 questions). The research method are the implementation of the survey activity and the data processing of survey result using Importance Performance Analysis (IPA). IPA assesses the various elements of the service pack and identifies the required actions. With IPA, all questions are grouped into four quadrants. X axis expresses the level of satisfaction and the axis Y states the level of importance. The questions that lie in quadrant 1 need to be a top priority for improvement because for students, the aspect is important but the quality of service is still low. The questions are the 6th and 7th questions in the academic aspect. The question is about the lecture and laboratory facilities. In terms of facilities, 7th and 8th questions about career and employment guidance services as well as scholarship services. The survey form is filled by 180 respondents who are active students of IPB Diploma Program in 2014.

Keywords : IPA, satisfactory, student, survey.

INTRODUCTION

Istiningtyas (2015) said that the sustainability of a company can not be separated from the role and existence of their customers. While Supranto (2006) said that service providers is something that must be done well. Parasuraman (1998) in Indrawati (2011) suggests five basic dimensions of quality. The dimensions are: (1) reliability, is a reliable ability; (2) Responsiveness, is the willingness to provide service and help the consumer immediately; (3) Assurance, that is, the knowledge and ability that employees have in providing services so the customers feel comfort with the services; (4) Empathy, is an important concern for the customer; (5) tangible, is the appearance of physical facilities, equipment / medium and communication media.

IPB Vovational School as an institution providing education service providers to users. The quality of service certainly needs to be improved to satisfy the customers, who in this case are students. Kotler (2004) in Istiningtyas (2015) states that satisfaction is interpreted as a feeling of pleasure or disappointment that the customer perceives on the comparison of an intermediate product expected with the results obtained from the product. Thus of course the quality of service significantly influence customer satisfaction and loyalty (Nugroho 2015). In his research, Normasari*et al*. (2013) states that the quality of service and customer satisfaction directly have a significant influence on corporate image.

Tjiptono (2006) suggests several ways that are used to measure customer satisfaction. There are (1) Complaints and suggestions system; (2) Customer satisfaction survey; (3) Ghost shopping; (4) Lost customer analysis. One of the efforts undertaken in order to improve the service is to conduct a satisfaction survey. This satisfaction survey activity in IPB Vocational School is conducted by the Discipline and Student Commission. Student Satisfaction Survey in IPB Vocational School is held every year.

The survey was included in descriptive research. Based on a large Indonesian dictionary, the survey is a research technique by giving clear limits on data; investigation; review. Survey in IPB Vocational School is done by distributing survey form to students in IPB Vocational School. The survey form that should be filled by students in the form of questionnaires. Form survei consists of 18 questions that are divided into two aspects. These aspects are academic (10 questions) and facilities (8 questions).

Survey results were analyzed using Importance Performance Analysis (IPA). Kottler and Keller (2016) said that IPA assesses the various elements of the service pack and identifies the action required. Kottler and Keller (2016) divide IPA into four quadrants. The quadrant can be seen in Figure 1. Quadrant A shows important customer service elements that are not performed. Quadrant B shows an important service element that is done well. This needs to be maintained by the service provider. Quadrant C denotes a less important element of service according to the consumer and the service of the company is mediocre. Quadrant D shows good service from the company but consumers consider this less important.

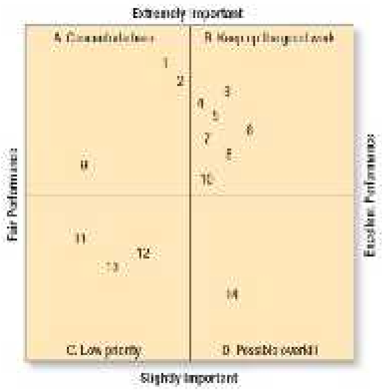


Figure1 IPA quadrant (Kotler and Keller 2016)

METHODOLOGY

The research methodology used in the analysis of student satisfaction survey consists of two stages. The stages are survey activity and analysis of survey results. In the IPA analysis, four quadrants will be created (Figure 2). In academic aspect, X axis expresses the level of satisfaction and the Y axis states the level of importance. While in facility aspect, X axis expresses the level of satisfaction and the Y axis states the level of use.Each question on the questionnaire will be calculated the average weight from level of satisfaction and level of importance or use. The questions will then be mapped into four quadrants. Low satisfaction and importance or use are rated 1 while high is rated 2.

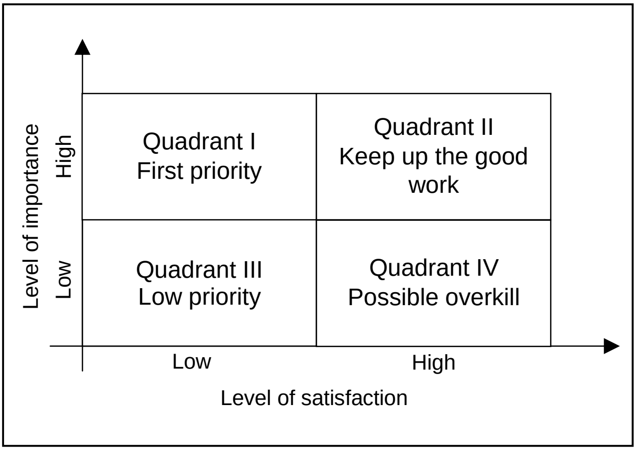


Figure2 IPA quadrant

The steps to map the questions into four quadrants in Figure 2 :

1. Each answer from respondests is weighted from 1 to 5.
2. calculate the average of each question weights (for example R1 for question 1, R2 for question 2 and so on).
3. Then the average value of all weights is calculated:

$$R^* = \frac{\sum_{i=1}^{n} R_i}{n}$$

Description: n = number of questions
Ri = average weight of question to i
R* = the average of all weighted averages

4. Ri values are compared with R*. If Ri <R* then rated 1 (low). If Ri> R* then rated value 2 (high).

5. The values 1 and 2 are combined for each Ri. Then each question is placed according to the combined values (Figure 3).

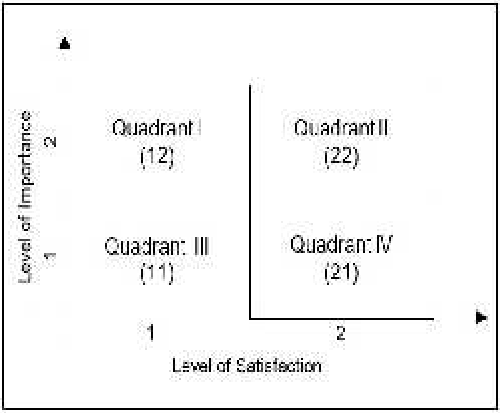


Figure 3 Questions mapping

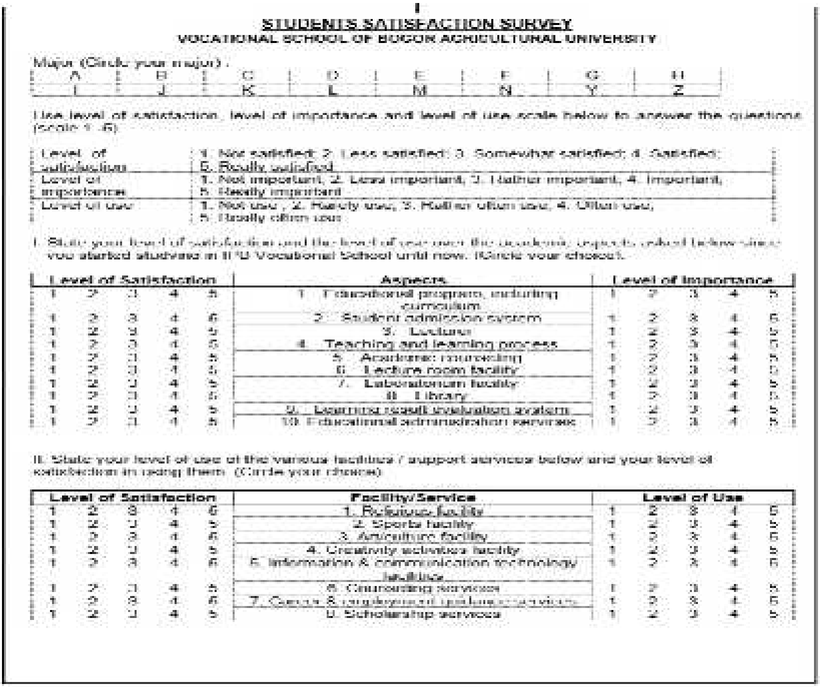
RESULT

Student satisfaction survey in IPB Vocational School was filled by 180 respondents from Computer Engineering Program. Questions raised on the survey form can be seen in Figure 4. The questions are 10 academic questions and 8 aspects of the facility. Respondents were asked to provide an assessment of 1-5 for each question.

The results of survey processing for the level of satisfaction and level of importance in academic aspects can be seen in Table 1. Each Ri declares the quadrant question. R* represents the limit of its quadrant. The value in the X axis is obtained from the level of satisfaction and the value on the Y axis is obtained from the importance level. Thus the IPA quadrant for the level of satisfaction and level of importance of academic aspects can be seen in Figure 5.

Table1 Results for satisfaction and importance level from academic aspects

AVE-RAGE	SATISFAC-TION	IMPORT-ANCE	VALUE (X)	VALUE (Y)	COMBI-NATION (XY)	QUAD-RANT
R1	3.74	4.22	2	2	22	II
R2	3.61	4.03	2	1	21	IV
R3	3.62	4.35	2	2	22	II
R4	3.66	4.20	2	2	22	II
R5	3.57	4.04	2	1	21	IV
R6	3.34	4.36	1	2	12	I
R7	2.85	4.37	1	2	12	I
R8	3.21	4.12	1	1	11	III
R9	3.60	4.13	2	1	21	IV
R10	3.16	4.17	1	1	11	III
R*	3.44	4.20				



STUDENTS SATISFACTION SURVEY
VOCATIONAL SCHOOL OF BOGOR AGRICULTURAL UNIVERSITY

Major (Circle your major) :

A	B	C	D	E	F	G	H
I	J	K	L	M	N	Y	Z

Use level of satisfaction, level of importance and level of use scale below to answer the questions (scale 1 -5)

Level of satisfaction	1. Not satisfied; 2. Less satisfied; 3. Somewhat satisfied; 4. Satisfied; 5. Really satisfied
Level of importance	1. Not important, 2. Less important, 3. Rather important, 4. Important, 5. Really important
Level of use	1. Not use , 2. Rarely use, 3. Rather often use, 4. Often use, 5. Really often use

I. State your level of satisfaction and the level of use over the academic aspects asked below since you started studying in IPB Vocational School until now. (Circle your choice)

Level of Satisfaction					Aspects	Level of Importance				
1	2	3	4	5	1. Educational program, including curriculum	1	2	3	4	5
1	2	3	4	5	2. Student admission system	1	2	3	4	5
1	2	3	4	5	3. Lecturer	1	2	3	4	5
1	2	3	4	5	4. Teaching and learning process	1	2	3	4	5
1	2	3	4	5	5. Academic counseling	1	2	3	4	5
1	2	3	4	5	6. Lecture room facility	1	2	3	4	5
1	2	3	4	5	7. Laboratorium facility	1	2	3	4	5
1	2	3	4	5	8. Library	1	2	3	4	5
1	2	3	4	5	9. Learning result evaluation system	1	2	3	4	5
1	2	3	4	5	10. Educational administration services	1	2	3	4	5

II. State your level of use of the various facilities / support services below and your level of satisfaction in using them. (Circle your choice)

Level of Satisfaction					Facility/Service	Level of Use				
1	2	3	4	5	1. Religious facility	1	2	3	4	5
1	2	3	4	5	2. Sports facility	1	2	3	4	5
1	2	3	4	5	3. Art/culture facility	1	2	3	4	5
1	2	3	4	5	4. Creativity activities facility	1	2	3	4	5
1	2	3	4	5	5. Information & communication technology facilities	1	2	3	4	5
1	2	3	4	5	6. Counseling services	1	2	3	4	5
1	2	3	4	5	7. Career & employment guidance services	1	2	3	4	5
1	2	3	4	5	8. Scholarship services	1	2	3	4	5

Figure 4 Survey form

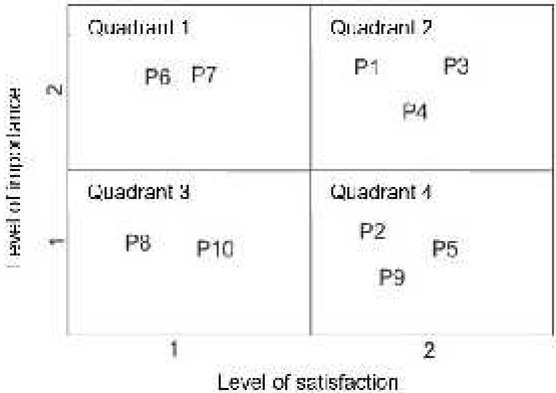


Figure 5 IPA Quadrant for academic aspects

From Figure 5, the questions that lie in quadrant I are P6 and P7. The questions in quadrant II are P1, P3 and P4. In Quadrant III there are two questions: P8 and P10. While the questions in quadrant IV are P2, P5 and P9. Thus it can be concluded that the types of services in the academic aspects that need to be top priority for improvement are lecture and laboratory facilities. Services that need to be maintained are educational programs, lecturers and teaching and learning process (Table 2).

Table 2 IPA Quadrant Conclusion for academic aspects

Quadrant	Questions	
I (First Priority)	P6	Lecture room facility
	P7	Laboratorium facility
II (Keep up the good work)	P1	Education program, including curriculum
	P3	Lecturer
	P4	Teaching and learning process
III (Low priority)	P8	Library
	P10	Educational administration services
IV (Possible overkill)	P2	Students Admission System
	P5	Academic counseling
	P9	Learning result evaluation system

Next, the results of the survey processing for the satisfaction level and the use of the facility aspect can be seen in Table 3. Each Ri declares the quadrant's query location. R * represents the limit of its quadrant. The value in the X axis is obtained from the level of satisfaction and the value on the Y axis is obtained from the usage level. Thus the IPA quadrant for the level of satisfaction and use of facility aspects can be seen in Figure 6.

Table 3 Results for satisfaction and use level from facility aspects

AVE-RAGE	SATISFAC-TION	USE	VALUE (X)	VALUE (Y)	COMBINA TION (XY)	QUAD RANT
R1	4.09	4.46	2	2	22	II
R2	2.68	3.84	1	1	11	III
R3	2.66	3.74	1	1	11	III
R4	2.82	3.91	1	1	11	III
R5	3.54	4.42	2	2	22	II
R6	2.88	4.14	1	1	11	III
R7	2.74	4.29	1	2	12	I
R8	2.86	4.49	1	2	12	I
R*	3.03	4.16				

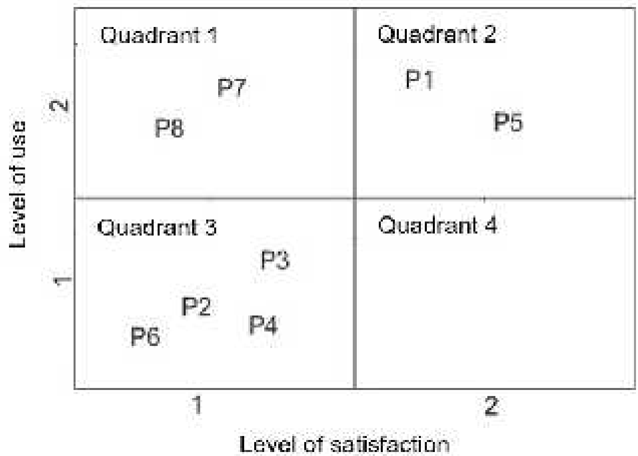


Figure 6 IPA quadrant facility aspects

From Figure 6, the questions that lie in quadrant I are P7 and P8. The questions in quadrant II are P1 and P5. While the questions in quadrant III are P2, P3, P4 and P6. There are no questions in quadrant IV category. Thus it can be concluded that the type of service in the aspect of the facility that needs to be top priority to be improved is the service of career and employment guidance services and scholarship services. While services that need to be maintained are those related to religious facilities and information and communication technology facilities (Table 4).

Table 4 Conclusions from IPA quadrant facility aspects

Quadrant	**Questions**	
I (First priority)	P7	Career and employment guidance services
	P8	Scholarship services
II (Keep up the good work)	P1	Religius facility
	P5	Information and communication technology facilities
III (Low priority)	P2	Sports facility
	P3	Art/culture facility
	P4	Creativity activities facility
	P6	Counseling services

CONCLUSIONS

As an institution of service providers, quality of service must always be improved to satisfy customers. IPB Vocational School as one of the institutions providing education service conducts Student Satisfaction Survey every year. This activity aims to see how far the quality of services provided. This survey is conducted by the Discipline and Student Commission. The survey results are processed using Importance Performance Analysis (IPA). Each question on the survey form is mapped into four quadrants. The first quadrant represents an important element of customer service that is not performed. The second quadrant shows important service elements that are done well. This needs to be maintained by the service provider. The third quadrant represents a less important element of service according to the consumer and the service of the company is mediocre. The fourth quadrant shows good service from the company but consumers consider this less important. Survey activities in 2014, followed by 180 respondents from Computer Engineering Program. The results of these activities on the academic aspect, which should be the main priority to be improved are the lecture and laboratory facilities. While the aspects that need to be maintained are education programs, lecturers and teaching and learning process. For facility aspects, which need to be the main priority of improvement are career and employment guidance service and scholarship service. While the aspects that need to be maintained are religious facilities and information and communication technology facilities.

REFERENCES

Indrawati A. 2011. Pengaruh Kualitas Layanan Lembaga Pendidikan terhadap Kepuasan Konsumen. Jurnal Ekonomi Bisnis, Th. 16 No. 1 : 25 – 35.

Istiningtyas L. 2015. Survei Kepuasan Alumni Terhadap Kualitas Pelayanan Program Studi Psikologi Islam Fakultas Ushuluddin dan Pemikiran Islam UIN Raden Fatah Palembang. PSIKIS-Jurnal Psikologi Islami. 1(2): 75-93. Palembang.

Kotler P, Keller KL. 2016. Marketing Management 15th ed. Pearson. ISBN 13: 978-1-292-09271-3. https://doi.org/10.1080/08911760903022556.

Normasari S, Kumadji S, Kusumawati A. 2013. Pengaruh Kualitas Pelayanan Terhadap Kepuasan Pelanggan, Citra Perusahaan dan Loyalitas Pelanggan. Jurnal Administrasi Bisnis. 6(2): 1-9.

Nugroho NT. 2015. Pengaruh Kualitas Pelayanan Terhadap Kepuasan dan Loyalitas Pelanggan. Jurnal Paradigma. 12(2): 114-122.

Supranto J. 2006. Pengukuran Tingkat Kepuasan Pelanggan. Jakarta. Rineka Cipta.

Tjiptono F. 2006. Manajemen Jasa. Yogyakarta. Andi.

DEVELOPMENT AND MANAGEMENT POWER PLANT MICRO HYDRO (PLTMH) IN THE AREA WITH THE TERRITORY WITH METHOD COMMUNITY EMPOWERMENT

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ABSTRACT

Penyong Kayan Village is one of the hamlets located in the Capital District of Lampung Barat. Although located in the Capital City but all residents have not got electricity from PT PLN. For daily lighting used kerosene/diesel at a price of Rp 10.000/dm^3. On the other hand, the location of the village is close to the flow of the Penyong Kayan river. By using community empowerment approach through Real Community Empowerment Learning Lecture (KKN PPM) activity has been built Micro Hydro Power Plant (PLTMH). The results of this activity are: 1) PLTMH with 10 KW power built successfully, 2) A total of 37 families have enjoyed electricity with power of 150 watts each. 3) Social capital and good natural capital has accelerated the success of PLTMH development, 4) The development of PLTMH has increased the income of the community through the saving of fuel expenditure amounting to Rp Rp 22,200,000 per year for 37 families, 5) The development of PLTMH conducted concurrently with the implementation KKN PPM proved effective to solve community problems, 6) Development of PLTMH in Penyong Kayan Village is able to increase project value significantly that is equal to 200%. To maintain the sustainability of this PLTMH, the steps taken are: 1) Established a group of PLTMH management under the name of Water Utilization Group (KPA/*Kelompok Pemanfaat Air*) TNBBS Siring Kujang, 2) Prepared Kampong regulations (*Peraturan Kampung*) on the utilization of PLTMH, 3) Technical guidance on PLTMH management.

Keywords: PLTMH, KKN PPM, Community Empowerment

INTRODUCTION

Penyong Kayan hamlet is a remote hamlet lies adjacent to Bukit Barisan Selatan National Park (TNBBS), located 7 km from the Capital District of West Lampung. Access roads so far so far not electricity from PT PLN. Meanwhile, for home lighting residents use diesel fuel. On the other hand, this village is bypassed by Way Siring Kujang River and Penyong Kayan River which can be used as a source of small / micro electric energy. From the initial survey found the potential power of 16 KW is enough to be used as a source of information for all citizens of Dusun Penyong Kayan (37 KK).

The limited economic and human resources, making the community unable to build PLTMH and manage independently. Several times applying for PLTMH development assistance to the district government but always failing, so the community feels that the government is not present when the community needs it. The longer this will result in the community not feeling as citizens of Indonesia. For this reason the program of development and management of PLTMH based on community empowerment is present when the community needs.

The Aim

Build a micro hydro power plant (PLTMH) using a local energy source (SES) with 10,000 watts of power using the community empowerment approach.

Problems

1. The economic level of the population is low.
2. Low level of education or low human resources.

Solution to problem

Using the community empowerment approach, namely:

1. Involving active community participation with the concept of mutual cooperation.
2. Involving students as motivators in mobilizing the community.
3. Using a community empowerment approach, not a project approach.

4. To maintain the sustainability of PLTMH, a group of PLTMH managers is formed.
5. To prevent the use of PLTMH conflict, Village Regulation on the utilization of PLTMH is planned.

Benefits of Activity

1. Can improve people's standard of living, quality of education and security.
2. Development of PLTMH with the concept of mutual assistance, able to maintain the preservation of culture mutual cooperation, so that will create community harmony.
3. Can increase public awareness in preserving the environment (forest) as a source of PLTMH springs.
4. Increasing the love of the homeland, because people feel the country is present when needed. PLTMH then drafted Village Regulation on the utilization of PLTMH.

METHOD OF IMPLEMENTATION

The steps of empowerment are: 1. Doing social engineering, namely: a. Doing planning programs together with the community, b.Doing mutual development, c. Arrange group of managers PLTMH, d. Develop village regulations on the utilization of PLTMH, e. PLTMH management training. 2. Perform engineering technology, namely: a. Design of turbine for 10 KW generator, b. Design of voltage control. While to measure the success rate of this activity is prepared with Indicator of Achievement as follows:

1. Quality of PLTMH System

One indicator to assess the success of research at the time of PLTMH development is an indicator of the quality of the PLTMH system (Table 1).

Table 1. Quality Indicators of PLTMH Systems

No	Description (Indicator) / Scale	5	4	3	2	1	Score
1	Electrification Ratio		x				x
2	Power PLTMH	X					x
3	Society of PLTMH management		x				x
Total score							∑x

Score Description: Very good: > 12, Good: 10 - 12, Fair: 7 - 9, Less: 4 - 6, Bad: <4

2. Social Capital and Natural Capital

The role of social capital and natural capital in the PLTMH system is very important. For this purpose, indicators such as presented in Table 2.

Table 2. Social Community Capital in Development of PLTMH

No	Indicator / Scale	5	4	3	2	1	Score
1	Culture mutual cooperation in building the village		X				x
2	Harmonization in relations between citizens			x			x
3	Natural capital		X				x
4	Quality of community human resources	x					x
5	Active participation of Pekon apparatus	x					x
Jumlah Skor							∑x

Score Description: Very good: 21 - 25, Good: 16 - 20, Enough: 11 - 15, Less: 6 - 10, Bad: 1 - 5

3. **Economic Benefits to Society**

Economic benefits gained, namely the form of savings in household expenditures due to the shift of use of diesel to PLTMH (Table 3).

Table 3. Economic Benefits of PLTMH Users

No	Description	Cost per month	**One year**	**Unit**	**Total (Rp)**	Description
A	Use BBM/Solar	R	Rx 12 month	37	T1	18.00 pm - 24.00 pm= 6 hours
B	Use PLTMH	P	P x 12 month	37	T2	24 hours
	Savings	H = R-P	Hx 12 month	37	TH	

With the assumption of cost / month as above T1 then in one year, people save on fuel expenses of Rp TH.

RESULT OF ACTIVITY

The result of the construction of Micro Hydro Power Plant (PLTMH) is the power of 10 KW power plant system.

DISCUSSION

To assess the success of this community empowerment, the assessment is done using indicators: 1. Successful development of PLTMH, 2. Benefits for the Environment, and 3. Project Value.

1. Successful Development of PLTMH

   a. Quality of PLTMH System

The quality of PLTMH system is seen from 3 indicators, namely: electrification ratio, generated power and managerial capability in managing PLTMH is presented in Table 4.

Table 4. Quality Indicators of PLTMH Systems

No	Description (Indicator) / Scale	**5**	**4**	**3**	**2**	**1**	Score
1	Electrification Ratio	x					5
2	Power PLTMH		x				4
3	Society of PLTMH management			x			3
Total score							12

Score Description: Very good:> 12, Good: 10 - 12, Fair: 7 - 9, Less: 4 - 6, Bad: <4

The resulting system is categorized well, but there are deficiencies in the manager caused by low quality of human resources. For that required continuous coaching by various parties, such as the Government of West Lampung District or NGO.

b. Social Capital and Natural Capital in the development and management of PLTMH: Social capital which is meant here is the quality of inter-community relations, cooperation in solving problems in society, education level, support of village government officials / Village, harmonization of inter-community relations. While the natural capital of natural resources owned by the community.

Table 5. Social Community Capital in Development of PLTMH

No	Indicator / Scale	5	4	3	2	1	Score
1	Culture mutual cooperation in building the village	x					5
2	Harmonization in relations between citizens	x					5
3	Natural capital	x					5
4	Quality of community human resources			x			3
5	Active participation of Way Empulau Ulu Villagers	x					5
Total score							23

Score Description: Very good: 21 - 25, Good: 16 - 20, Enough: 11 - 15 Less: 6 - 10, Bad: 1 - 5

Judging from social capital, residents of penyong kayan village is very good with score 23. It is also proved that in PLTMH development the community actively participate, so that activities can be completed quickly that is for 2 months. However, because the quality of human resources with low education, so that guidance in the management of PLTMH must be done continuously, this is the responsibility of the West Lampung District Government.

c. **Economic Benefits to Society.**

This PLTMH has directly provided economic benefits for the user community, that is, savings in spending on home lighting and possible utilization for economic value business activities (coffee heater, business of making the frame, chicken egg hatching and so on). The value of economic benefits as presented in Table 6.

Table 6. Economic Benefits of PLTMH

No	Description	Cost/month **(Rp)**	One yr	**Unit**	**Total (Rp000)**	Description
a	Use of 2 lt / week diesel oil (price Rp 10.000/ltr)	80.000	960.000	37	35.520	18.00 pm - 06.00 am
b	PLTMH for lighting	30.000	360.000	37	13.320	24 hour
	Savings	50.000	600.000	37	22.200	

Assuming the cost / month as shown in Table 6, whereas the people who use the PLTMH amounted to 37 families, then within one year, the community saves fuel expenses of Rp22,200,000.

2. **Other Benefits of PLTMH for Society and the Environment.**

Much of the benefits of PLTMH in addition to those described above, including: environmental, educational and research benefits (Table 7).

Table 7. Other Benefits For MHP Development

No	Benefit	Description
a	Environment	✓ Communities are forced to maintain the sustainability of water resources. ✓ Community will be easy to invite to jointly do tree planting movement in forest area ✓ The threat of landslide will be reduced and even prevented. ✓ In the long run there will be a decrease in the temperature of the micro area. This is

No	Benefit	Description
		done en masse then will participate in efforts to decrease global temperature.
b	Education	✓ In the long term it can improve the quality of education for school-aged children. ✓ As a place of education for school-aged children or for society, that nature taught us that our natural environment is our natural friend.
C	Research	✓ Can be used as a place of research for researchers about: Renewable energy, environmental and social engineering.

3. **Value of Projects Generated**

Using a community empowerment development model by involving Community Service Program Community Empowerment Learning (KKN PPM) students actively through KKN PPM grant, it can increase the project value from Rp 95,000,000 to Rp 190,215,000 with details of State Budget of Rp 95,000,000, community contribution Rp 63,765,000 , partner contribution Rp 2.500.000 and Lampung University assistance Rp 28.950.000. A considerable value for the community and a widespread impact on society.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

From the results of research activities under the title "Development and Management of Micro Hydro Power Plant (PLTMH) in Disadvantaged Areas With Community Empowerment Method", some conclusions can be drawn:

a. The construction of PLTMH with 10,000,000 Watt power in Penyong Kayan Village, was successful and 37 people have been enjoying electricity with each power of 150 Watt.
b. Social capital and good natural capital in Penyong Kayan Village has accelerated the success of PLTMH development.
c. Economically the development of PLTMH has increased the income of the community through the savings of fuel expenses amounting to Rp Rp 22,200,000 per year for 37 families.
d. The development of PLTMH in Penyong Kayan Village by using this community empowerment model can increase the value of the project significantly that is equal to 200%, that is from Rp 95.000.000 grant fund to Rp 190.215.000.

Suggestions

a. This applied research-based development program needs to be expanded and multiplied by its quota, given that the program can solve real community problems.
b. Need to be developed in remote areas, outermost, leading or underdeveloped areas with larger funds.
c. Given the success of the empowerment program, it is necessary media to spread this success, both scientific and scientific media popular. Therefore, Kemeristek Dikti is expected to facilitate it.

REFERENCES

Hartoyo, Fauzan Murdapa, Dwi Haryono, dan R. Sigit Krisbintoro, 2012., "*Urgensi Kepemimpinan, Modal Sosial dan Kerja Kolektif Dalam Pemberdayaan Desa Mandiri*." Jurnal Masyarakat, Kebudayaan dan Politik, Volume 25 No. 3 (2012)

Hartoyo, Fauzan Murdapa dan Dwi Haryono., 2014.," *Pengembangan Desa Mandiri Energi Melalui Integrasi antara Masalah dan Aset Lokal",* Universitas Lampung, Bandar Lampung.

Murdapa, F., Yuliarto, S. Sulastuti, dan R. Sigit K., 2010.," *Pemanfaatan Air Terjun untuk Pembangkit Listrik Tenaga Air*

(PLTMH) di Desa Pesawaran Indah, Kecamatan Padang Cermin, Kabupaten Pesawaran", Prosiding Seminar Dies Natalis Universitas Lampung ke 45, Bandar Lampung.

Murdapa, F. dan Dwi Haryono., 2014.,"*Desa Mandiri Energi Berbasis PLTMH dan Biogas",* Universitas Lampung, Bandar Lampung.

Murdapa, F., Dwi Haryono, Sugeng PH, Yuliarto R dan Sigit K., 2016., "*Model Pemberdayaan Desa Mandiri Energi Dalam Rangka Meningkatkan Pendapatan Masyarakat Melalui Penguatan Lembaga Koperasi Desa*", Prosiding Seminar Nasional Pendidikan Vokasi Indonesia Tahun 2016: Inovasi Teknologi dan Pembangunan Sumberdaya Manusia Berdaya Saing Memasuki Era MEA. Universitas Halu Oleo Kendari.

BUSINESS ANALYSIS AND ADDED VALUE OF GOAT MILK SOAP IN THE AS-SALAM AGRIBUSINESS GROUP IN TASIKMALAYA CITY

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ABSTRACT

Dairy goat breeding business is now a profitable business opportunity for farmers in Indonesia. More and more people are aware of the nutritional benefits of goat milk, as both food and non-food products. The purpose of this business development plan was to formulate the idea of business development in the As-Salam Agribusiness Group, as well as to review the business development plan in increasing the added value of goat's milk as soap, financially and non-financially. Non-financially, viewed from market and marketing aspect, promotional media of word of mouth and social media is planned to be used. The using of appropriate and easy to get tools is also planned to be used, viewed from production aspect. From organizational and human resources aspect, it is planned to be in accordance with the qualification of labor needed. Collaboration aspect is adapted to the needs of raw materials to be used in the production process. Based on financial aspect, the NPV is Rp 33 578 088, 2.83 Net B/C, 70 percent IRR, 3 years 4 months payback period. It is concluded that this activity is eligible to be implemented. If the As-Salam Agribusiness Group decides to run this business, the thing to note is the decrease in sales of goat milk soap at 12 percent decline. This condition can be prevented through promotion, bonus for consumers, as well as the product quality maintenance.

Keywords: dairy goat, feasibility studies, soap

INTRODUCTION

Livestock is one of the agricultural sub-sectors that have a very important role for the development of the national economy. One of the most widely cultivated livestock commodities is dairy goat. Dairy cattle business is now a lucrative business opportunity for farmers in

Indonesia. Because more and more people are aware of the nutritional benefits contained in goat's milk. Goat milk has relatively high nutrient content and good for health. The comparison of nutritional content of goat and cow's milk in Table 1.

Table 1 shows that the nutrient content found in goat's milk relatively high when compared with cow's milk. High levels of protein, fat, iron, vitamin A, vitamin B, and vitamin D can also soften and moisturize the skin, brighten the skin, cure acne, remove black spots and spots on the skin, and eliminate wrinkles on the face. With the benefits found in goat milk soap can increase demand from consumers.

Table 1 Nutritional content of goat and cow milk per liter

Compotition nutrition	Unit	Goat milk	Cow milk
Energi	Kkal	670	660
Protein	G	33	33
Fat	G	40	37
Kalsium (Ca)	mg	1 290	1 250
Fosfor (P)	mq	1 159	1 103
Potasium (K)	meg	46	45
Ferrum (Fe)	mg	1	0.5
Klorida (Cl)	mg	1 200	1 050
Vitamin A	IU	2 074	1 500
Vitamin B-1	mg	0.400	0.44
Vitamin B-2	mg	0.1840	0.21
Vitamin B-3	mg	1.9	1.0
Vitamin B-6	mg	0.70	0.64
Vitamin D	IU	24	14

Source : El-Zenini (2006) *in* Budiarsana dan Sutama (2017)

As-Salam Agribusiness Group is a group of farmers engaged in cultivation of livestock, especially Etawa Crossbreed (PE) and milk processing. The sales of goat milk in the As-Salam Agribusiness group decreased, causing the milk to be sold out and not yet well utilized by the group. The demand and supply of goat milk in the As-Salam Agribusiness group can be seen in Table 2.

Table 2 Supply and demand of goat milk in the As-Salam Agribusiness group

Year	Demand (liter)	Supply (liter)	Gap (liter)
2015	7 300	4 927.5	- 2 372.5
2016	3 102.5	4 927.5	1 825
2017 (January – April)			
January	135	160	25
February	135	160	25
March	135	160	25
April	135	160	25

Source : Primary Data 2017

Based on the information in Table 2, demand for goat milk each year decreased. According to the head of the As-Salam Agribusiness group, this decline is due to the price of goat milk which is expensive when compared with cow's milk and customers of goat's milk only consumers who need goat's milk as a medium of treatment only. As a result, milk becomes abundant and has not been well utilized by the As-Salam Agribusiness group. Looking at the characteristics of perishable milk, milk processing needs to be done to extend the shelf life and increase the selling value.

Besides can be drunk, goat's milk can also be used as skin care. Currently, there are many beauty products that add milk as a base material such as soap. Goat milk soap is one of the alternative ways to maintain healthy skin. By using goat milk soap, the skin will be kept clean and protected from dirt and germs that stick. Soap with goat's milk is able to cleanse the skin without causing dry skin and irritation and also has a content of whitening extract that makes skin look brighter.

Survey of market conditions for goat milk soap is done by interviewing consumers directly. Target consumers are the students and housewives who are in Tasikmalaya. From the results of these activities, the demand for goat milk soap contained in Table 3.

Table 3 Market demand of soap goat's in 2017

No	Market observation	Demand (pcs)
1	Siliwangi university	50
2	UMTAS	35
3	UPI Tasikmalaya	25
4	LP31 Tasikmalaya	30
5	Poltekkes Tasikmalaya	50
6	Keperawatan Tuna Bakti Husada	30
7	Perjuangan University	28
8	Wife house	115
	Amount	363

Source : Primary data 2017

Tabel 3 menunjukkan adanya permintaan terhadap sabun susu kambing. Dengan adanya data tersebut, dapat memberikan peluang bagi kelompok Agribisnis As-Salam untuk memproduksi dan memenuhi permintaan sabun susu kambing.

In Table 3 shows the demand for goat milk soap. Based on the data, it can provided an opportunity for the As-Salam Agribusiness group to produce and meet the demand for goat milk soap. The purpose of study writing business development plan on As-Salam Agribusiness group is as follows: (1) Formulate the idea of business development in the group of As-Salam City Tasikmalaya Agribusiness; (2). Business analysis development plan to increase the added value of goat's milk to soap in the Tasikmalaya As-Salam Agribusiness group wich is non financially and financially aspect.

METHODOLOGY

This business development study is based on the results of Field Work Practices (PKL) conducted in the As-Salam Agribusiness group located in Salamnunggal Village Rt / Rw 02/08, Sirnagalih Sub-district, Indihiang Sub-district, Tasikmalaya City, West Java. Data collection techniques in writing business development study report conducted by interview, observation, and literature study. This business development study uses nonfinancial analysis and financial analysis. Non-financial analyzes include market and marketing aspects, production aspects, organizational and management aspects, human resource aspects and collaboration aspects. Financial analysis includes cash flow, income analisys, and switching value analysis.

RESULT

Business development increasing added value goat milk to soap in the As-Salam Agribusiness group started from milk problems that are not sold out and have not been well utilized by the group. The idea of business development in increasing the added value of goat milk to soap in the As-Salam Agribusiness group is derived from the decrease of SWOT analysis in the form of strategy (S-O) ie Strength and Opportunity. The formulation of business development idea of increasing the added value of goat milk into soap can be seen in Figure 1.

Product Planning

The product plan that will result from this business development idea is dairy goat milk soap. Goat's milk soap is a beauty soap for facial skin. Goat's milk soap to be made has a natural aroma without a mixture of deodorizer. To be easily recognized by consumers, the As-Salam Agribusiness group trademarks the goat milk soap product it produces. The soap is trademarked "Savera Goat's Milk Soap".

Marketing Strategy

1. Market segmentation; in business unit of goat milk soap product is based on geographical area of Tasikmalaya. Demographic with the age of 17 years to 50 years and has a middle income of Rp 1 000 000 to Rp 5 000 000. Psychographic is a woman who cares about beauty.
2. Targeting; the target market of the products is located around Tasikmalaya region. Target consumers for goat milk soap products are students and housewives with the age range 17 years to 50 years.
3. Positioning product; determination of products made in the sale of goat milk soap is "Shown Beautiful with Goat Milk Soap". The superiority of goat milk that has Alpha Hydroxyl Acid (AHA) content is able to remove dead skin cells, repair cells and can cure acne prone skin.

Marketing Mix

1. Product; the product to be produced by As-Salam Agribusiness group is dairy goat milk soap. The raw materials used are goat milk, olive oil, coconut oil, palm oil, and sodium hydroxide (NaOH). Goat's milk soap is made in 30 gram packages and packed with boxed boxes. Form of soap that is made that is round. Soap that will be packed into the box first coated by plastic wrap to make the product more sterile. According to the head of the As-Salam Agribusiness group, goat milk soap has a shelf life for one year.

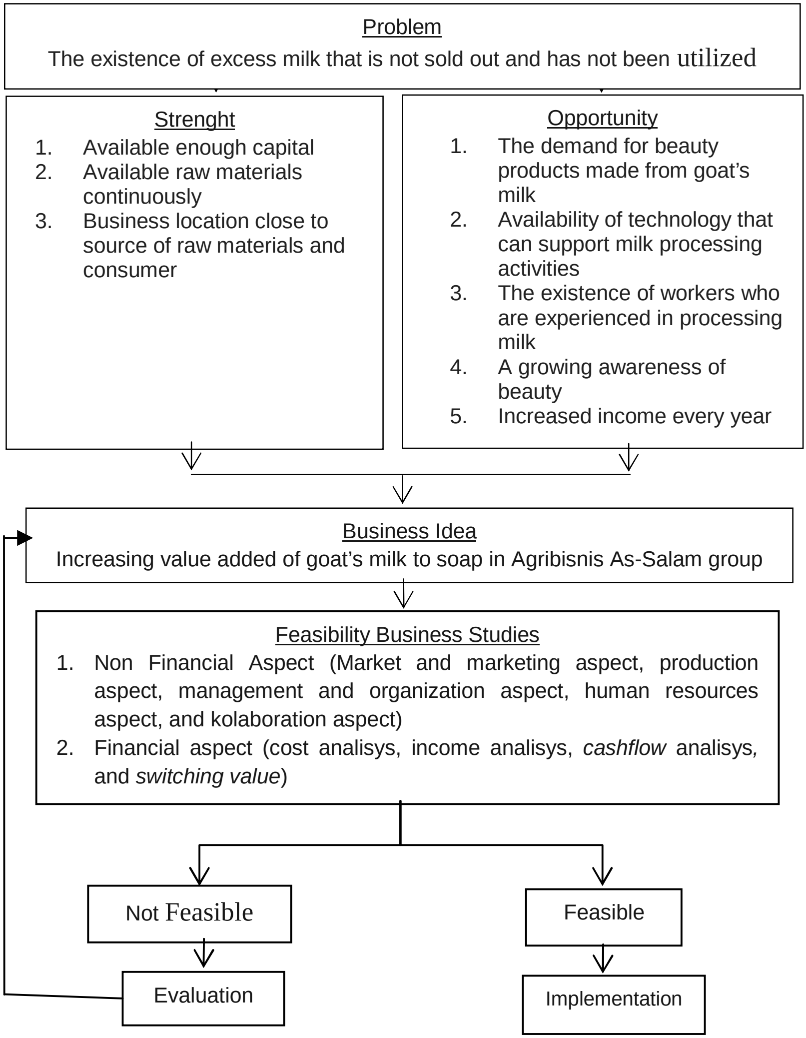

Figure 1 Formulation of business development ideas

2. Price; the determination of the price goat milk soap products based on the cost of production (HPP) of Rp 11 442 with the selling price to the consumers Rp 15 000 and the mark up used by 24 percent in the first year and in the second year cost of production (HPP) Rp 10 947 with the selling price to consumers Rp 15 000 and mark up used by 27 percent.
3. Distribution Channel or Place; distribution made by As-Salam Agribusiness group for goat milk soap is by offering products to students and housewives who are in Tasikmalaya. The population of women aged 17-50 years in Tasikmalaya according to the Central Bureau of Statistics Year 2015 as many as 178 325 inhabitants. The assumption of 2 percent marketing of goat milk soap products that can be marketed to students and housewives as much as 3 528 pcs. Product acceptance percentage is based on production planning in the first year for 9 months.
4. Promotion; promotion is implemanted by method "word of mouth" as the main step of product introduction. The second promotion plan is through social media such as instagram and facebook.

Production Planning

The resulting production is adjusted to the existing raw materials in the As-Salam Agribusiness group. The raw material used for making soap is by utilizing the milk that is not sold out. In the first year the As-Salam Agribusiness group needs 1.2 liters of milk per week. The main raw material and additional raw material will get 392 pcs result with 30 gr weight per month. As-Salam Agribusiness group will process goat milk as much as 57.6 liters / year (assuming 4.8 liters / month). The processed of goat milk soap can be seen in Figure 2.

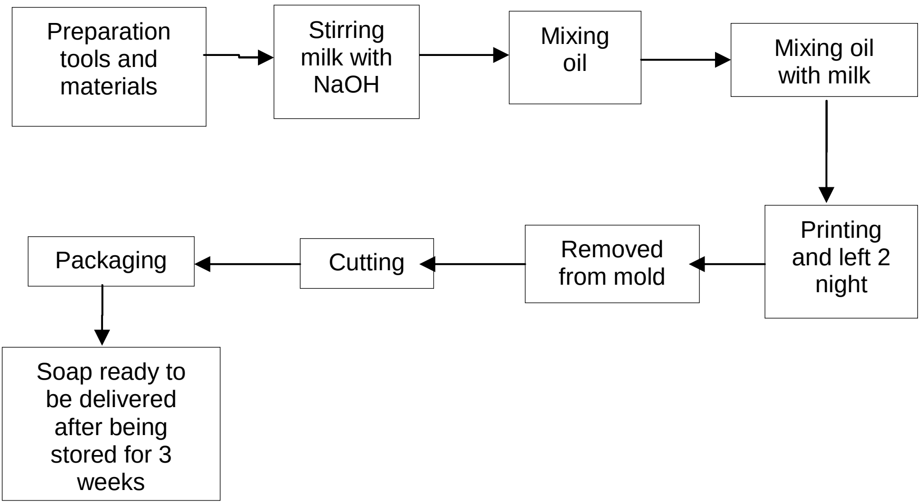

Figure 2 The process of milk goat's soap

Organizational and Management Planning

Planning efforts to increase the value added of goat's milk into soap requires the addition of a workforce in the processing and marketing department. The labor is taken from the area around the business location.

Human Resource Planning

Qualifications required for the labor of the processing department of women aged 25-35 years, minimum education junior equivalent and responsible. The planned salary for the production labor is Rp 1 000 000 / month. Manpower in the marketing department with the qualifications required are women aged 22-35 years, minimum junior high school education, able to ride a motorcycle and have a license and have the ability in the field of marketing / promotion. Planning salary for labor part of marketing that is equal to Rp 1 300 000 / month. Collaboration planning in business unit of goat milk soap is to cooperate with farms belonging to As-Salam Agribusiness group to get the main raw material of goat milk. The second collaboration plan is to establish cooperation with Sari Kimia store having its address at Jl. Mitra Batik, Tasikmalaya for the acquisition of additional raw materials of sodium hydroxide (NaOH).

Financial Planning

The cost components of the financial aspect of increasing the added value of goat's milk to this soap use basic assumptions that are tailored to the group condition. The basic assumptions on the plan to increase goat milk value added to soap as follows:

1. Sources of funds from their own capital.
2. Business life set for 5 years based on the economic age of most investment components (freezers and blenders).
3. Discount rate taken is based on deposit interest rate from BRI on May 15, 2017 which is equal to 6.4%.
4. Income tax according to Government Regulation No. 46 of 2013 concerning income tax on income from business received or obtained by a taxpayer having certain gross income. If the gross income or gross income of businesses is below 4.8 billion, the tax rate imposed by 1 percent (%).
5. Goat milk soap production activities are assumed 1 time in 1 week. The amount of goat milk soap production is assumed to be

98 pcs per week, 392 pcs per month and 4 704 pcs per year. The failure rate in the year 1 to 5 is 1%.

6. In year 1 to perform production activities for 9 months and 2nd to 5th year of production activities conducted for 12 months.

The income statement is a report that contains the total receipts, expenses, and profit conditions that a business acquires over the life of the business. The results of profit and loss calculations can be seen in Table 7.

Table 7 The income statement

Uraian	Tahun 1	Tahun 2-5
Total revenue (Rp)	52 920 000	70 560 000
Variable cost (Rp)	6 239 700	8 319 600
Gross profit (Rp)	46 680 300	62 240 400
Depreciation (Rp)	4 339 500	4 339 500
Fixed cost (Rp)	39 528 500	50 376 500
EBT (Rp)	7 151 800	11 863 900
Tax (Rp)	529 200	705 600
EAT (Rp)	6 622 600	11 158 300

Reception in this business is obtained from the sale of goat milk soap products of 30 grams per pcs with the price of Rp 15 000. Details of receipt can be seen in Table 4.

Table 4 Acceptance of sales of goat milk soap

Component	Amount	Unit	Price unit (Rp)	Total (Rp)
Goat milk soap (1 year)	3 528	30 gr/pcs	15 000	52 920 000
Goat milk soap (2-5 year)	4 704	30 gr/pcs	15 000	70 560 000

In determining the feasibility of a business required several criteria that become a reference so that a business can be said worthy or not. These criteria are based on the investment criteria listed in Table 5.

Table 5 Business feasibility criteria

No	Investment criteria	Eligibility criteria	Result of analisys
1	NPV	>0	Rp 33 578 088
2	IRR	>*Discount Rate*	70%
3	Net B/C	>1	2.83
4	PP	<Umur Bisnis	3.37 (3 year 4 mont)

Switching value analysis is one form of sensitivity analysis used to measure how sensitive the cash flow in the company to changes such as decreased sales of goat milk soap. The result of switching value calculation can be seen in Table 6.

Table 6 Switching value analysis

Condition	Great change (%)	NPV (Rp)	IRR (%)	*Net* B/C
Decreasing sales of soap	12	0	6.4	1
The rise in the price of olive oil	156	0	6.4	1

CONCLUSIONS AND SUGGESTIONS

Conclusions

The results of feasibility analysis in the financial and non financial business become the assessment of business development plan. Financial analysis of NPV amounting to Rp 33 578 088 and greater than 0. Net B / C is considered feasible because it obtained for 2.83 greater than 1. Payback period is considered feasible because the rate of return on investment is faster than the business life for 3 years 4 months from the business age of 5 years. IRR business return is said to be feasible because it obtained IRR of 70 percent and greater than the discount factor rate of 6.4 percent. The value of the switching value of this business development will be disadvantaged and unfeasible if the sales volume decrease exceeds 12 percent and the increase in the price of olive oil exceeds 156 percent.

Based on the results of the analysis can be seen from the financial aspect of this business development plan is profitable. Non-financially viewed from market and marketing aspect is planned by using media of promotion of word of mouth and social media, production aspect using suitable tools and easy to get, organizational aspect and management and human resources planned according to qualification of labor needed, aspect of collaboration tailored to the needs of raw materials to be used in the production process. It is concluded from both financial and non financial aspects that this business is feasible to run.

Suggestions

As-Salam Agribusiness Group can anticipate a decrease in sales at the limit of 12 percent decline. This condition is prevented through increased promotion, increasing consumer interest by offering bonus purchases to consumers, as well as maintaining product quality. The maximum increase of olive oil is still acceptable that is equal to 156 percent. Chances are if the increase in the price of olive oil raw material exceeds the maximum limit then look for alternate oil alternatives for use in the production process. The result of this business development is expected to be a suggestion for the As-Salam Agribusiness group to increase profits and be able to utilize the excess milk that is not sold out

REFERENCES

Anggraena L, Maylani V dan Ramadhan DA. 2017. *Kajian Lingkungan Bisnis Peternakan Kambing pada kelompok Agribisnis As-Salam Kota Tasikmalaya.* Bogor (ID). Program Diploma IPB.

Budiarsana IGM, Sutama I-K. 2017. *Kupas Tuntas Beternak Kambing.* Jakarta (ID): Penebar Swadaya.

Kasmir, Jakfar. 2003. *Studi Kelayakan Bisnis.* Jakarta (ID): Prenadamedia Group.

Lipsey, Wasana J, Kirbrandoko. 1995. *Pengantar Mikroekonomi jilid 1.* Jakarta (ID): Binarupa Aksara.

Nurmalina R, Sarianti T, Karyadi A. 2014. *Studi Kelayakan Bisnis.* Bogor (ID): Fakultas Ekonomi dan Manajemen Departemen Agribisnis Institut Pertanian Bogor.

Sukirno S. 2013. *Teori Pengantar Mikro Ekonomi.* Jakarta (ID): PT Raja Grafindo Persada.

ANALYSIS OF SOCIETY'S PARTICIPATION AND SUSTAINABLE TRANSPORTATION TO REGIONAL DEVELOPMENT AT MEDAN

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ABSTRACT

Regional development basically aims to improve the welfare of the people of a region in a sustainable manner. Sustainable transportation is an aspect of global sustainability that contains three related components, that is environment, society and economy. Major cities are bound to transportation system if they wish to grow and fully developed in the future, and we choose to analyze in Medan. The purpose of research is to explain the effect of society's participation and sustainable transportation towards regional development at the city of Medan. The research is conduct by using explanatory approach using primary data with purposive sampling method based on criterias of 300 respondents, and the data analysis is using path analysis and regresion. The result showing that participation of society and the sustainable transportation are positively and significantly affecting and regional development at Medan. Sustainable transportation is positively and significantly affecting regional development in Medan. Variables of participations of society are in form of participation in decision making, execution and evaluation of transportation in Medan. Variables of sustainable transportation are in form of social, economic and environment of transportation in Medan. Variables of regional development are in form of local revenue growth (PAD), economic growth, and employment in Medan. Suistanable transportation as a mediating (partial intervening) relations participation of society to regional development in the city of Medan. In order to support the sustainable transportation in Medan there are need of active participation of society.

Keywords : participation of society, sustainable trasnportation, and regional development.

INTRODUCTION

Background

The city is the future residence of the world's population, so it needs to be prepared early to become a comfortable, safe and more open place to interact with fellow citizens, and more environmentally friendly. Roland Busch, CEO of Infrastructure and Cities Sector Siemens, at the World Cities Summit held early June 2014 in Singapore revealed; "That in 2009 alone, half the world's population lives in urban areas, estimated by 2030, the population living in urban areas will account for two-thirds or 3.5 billion to 4.7 billion people." This means that the burden of the city increasingly heavy and inevitable, the increased activity and mobility of citizens require the development of effective and efficient public transportation, adequate and integrated infrastructure, and the contribution and participation of the community is more optimal.

One of the factors that need attention is the increasing number of Indonesians living in urban areas. The increase in the number of urban residents is partly due to the increasing number of people from the rural areas that become city dwellers. Based on estimates in 2025 the number of people living in urban areas will reach 60%, whereas the number of people in rural areas is decreasing. Viewed from the physical aspect, urbanization in Indonesia is characterized by: (1) widespread urban area due to the rapid development and widening of suburban areas, especially in big cities and metropolitan areas in Indonesia, (2) widespread physical urban development in sub-urban areas has 'integrated' smaller towns around its core city and formed an uncontrollable conurbation, (3) increased number of urban villages (villages classified as urban areas), (4) most urbanization (30-40%) occurred due to (5) Transborder provinces (East Kalimantan, Riau, North Sumatra) tend to have a high percentage of urban population, (6) The rate of urban population growth in the metropolitan area tends to decrease, while in the surrounding area increases. Therefore urbanization must be seen not only the process of migration of villagers to the city, but also includes the process of 'pengkotaan' rural areas.

Medan is the gateway to the western part of Indonesia as well as a gateway for tourists to the tourist attractions of Brastagi in the highlands of Karo, Orangutan attractions in Bukit Lawang, and water attractions in Lake Toba. The rapid development of Medan city as the third largest city in Indonesia with high population growth, increased activity and mobility is also high, but the area that remains (no increase) raises various problems, especially related to regional development. In April 2014 the President of Indonesia inaugurated Kuala Namu International Airport as a sign of a new round for Medan to go International. This reality of course has consequences with the emergence of various problems and dynamics of regional development, such as population problems and heterogeneous community dynamics, land availability, transportation infrastructure problems, sustainable transportation problems, and various other problems associated with the development of the Medan region.

The population growth of Medan in the last 12 years from 1,993,602 in 2003 to 2,497,183 in 2014 means that it grew more than half a million people or 503,581 inhabitants, but on the other side of the fixed area (265,100 M2) so it is natural to bring up various problems as presented by Prof. Sirojuzilam in his book "The Problematic Area of the city and the region". This population growth is automatically followed by the growth of activity, mobility, and various needs of human life such as clothing, food, and board or residence. Various aspects of regional development will also create transportation problems, almost all major cities in Indonesia experience this, which covers aspects of network operations, financial, economic, environmental, and safety. Indications of problems arising in these aspects are evident from traffic congestion, an increasing proportion of personal use, high accident rates, inefficient fuel consumption, and so on. These regional development issues caution that transportation issues require comprehensive community participation, thinking and handling with the awareness that a focus needs to be given to improving the efficiency and effectiveness of existing infrastructure, as well as optimizing limited resources for the development of transport systems in anticipation of regional development. (Sjafruddin A, 2011).

The growth of the number of vehicles in various regions, especially the city of Medan is not balanced with the availability of roads and other supporting transportation infrastructure. This has become a problem today and also in the future if not immediately fixed and sought solutions. The number of public and private transportation facilities in Medan in the last 10 years increased from 1,022,755 vehicles in 2004 to 5,381,566 vehicles in 2013 or grew by 4,358,811 vehicles (426%) see Table 1.2, but on the other hand the road in the city of Medan in the last 10 years only grew 29.2 km (0.096%), where in 2003 the length of the road in the city of Medan (state roads, provinces and cities) was 3,035.41 km to 3,064.61 km in 2013 , or hardly grew at all. These conditions and problems will be more severe in the future if not immediately addressed properly. Moreover, the center of the economy, social, cultural and political is in urban areas, so the growth of the transportation sector becomes very high.

ANTARA News, 2013, reported that social costs wasted due to traffic congestion in Jakarta and surrounding areas are estimated at Rp. 68 trillion per year. What about Medan city? did anyone ever try to calculate how much is wasted? Analyze News 2014, reporting social cost loss only due to traffic congestion in Medan reached Rp. 5.2 trillion per year. Number Rp. 68 trillion and Rp. 5.2 Trillion is large enough, and when allocated to help the welfare of society, education, health and or to build infrastructure and public facilities so great benefits. Therefore, for the better development of the city of Medan in the future, it is necessary to know the influence of the role of community participation, the development of transportation infrastructure, and integrated transportation that is well integrated, in order to be able to bring the successful development of Medan city area with more optimal benefits for all parties in the long-term dimension.

Seeing the description of some problems and potential problems that may be faced by the city of Medan in the future related to the development of the region, then we can formulate the problems as follows.

Research Objectives

1. To analyze the influence of society participation on sustainable transportation in Medan City.
2. To analyze the effect of sustainable transportation on the development of the region in Medan City.
3. To analyze the influence of society participation and sustainable transport together (simultaneously) to the development of the region in the city of Medan.

METHODOLOGY

Type of Research

This type of research is causal, Umar (2008) mentions a causal design is useful to analyze how a variable affects other variables, and also useful in experimental studies in which the independent variables are treated in a controlled manner by the researchers to see the impact on the dependent variable directly.

Place and Time of Research

This research is empirically located in the city of Medan and its surroundings, especially the central area of the city or center area, midle area and urban area (urban area). More specifically done in the large terminals in Medan and some offices for heads and staff of relevant agencies and institutions; BAPPEDA (Regional Planning Board), ORGANDA (Tranportation Organization Association), DISHUB (Departement of Transportation), MTI (Indonesian Transportation Community), and KPUM (Cooperative of Medan Public Transportation) . Study time from June 2016 to September 2016.

Population and Sample

According Sugiyono (2008): "Population is a generalization region consisting of: objects / subjects that have certain qualities and characteristics set by researchers to be studied and then drawn conclusions. The population in this study is the entire population of Medan city. The population of Medan city in 2015 is 2,468,429, consisting of 1,241,826 men and 1,226,603 women. The sample is part of the number and characteristics possessed by that population. In this research, the object of research is public transportation stakeholder (community, user, owner and stakeholders / SKPD) related in the research. Sampling model in this research using technique of non probability sampling (pusposive sampling), is one of sampling technique which means purposive sampling technique based on certain criterion from writer. Researchers determine their own samples taken because there are considerations or certain criteria associated with the study. The criteria are as follows:

1. Drivers of public transport in the area of Medan and surrounding areas
2. Passenger public transportation in the city of Medan and surrounding areas
3. Pedicab driver Motor in Medan city area
4. Owners of public transport in the city of Medan and surrounding areas
5. Board and / or Member of ORGANDA
6. Management and / or Member of MTI (Masyarakat Transportasi Indonesia)
7. Board and / or Member of KPUM (Medan Public Transportation Cooperative)
8. Officials and or Officers of Medan Transportation Department
9. Officials and or Officials of Medan City Spatial Planning Office
10. Officials and or employees of Bina Marga Medan
11. Officials and or Staff of BAPPEDA Medan

The sample is a subset of the population unit (Kuncoro, 2003). The sample size of the community respondents was determined following Roscoe’s opinion (Sugiono, 2003), which states that no matter how large the population is in social studies the sample size is worth between 30 and 500 people. Based on the above opinion, the sample set as many as 300 respondents related to the research.

Data collection technique

Technique of collecting data used by primary data from questionnaire, where questionnaire is technique of data collection where writer make question or statement list in the form of questionnaire addressed to respondent that is public transportation user society, leadership and or SKPD staff that related in research, using Likert scale (ordinal data) with checklist form. In this study also uses secondary data from BPS and various sources to support the analysis of research results.

Data Analysis Model

Testing Validity and Reliability

Instruments are tools for collecting data, good instruments are instruments that are in accordance with the nature of the data to be collected and can assure that the data collected is valid and reliable. A valid instrument must have internal and external validity. Instruments that have internal or rational validity, if the criteria present in the instrument rationally reflect what is measured. Validity indicates the extent to which a gauge measures what it wants to measure. A measuring scale is said to be valid if the scale is used to measure what should be measured. Simply validity has 3 types namely (1) Construct Validity (Conctruct Validity). Constructs are the framework of a concept. By knowing the skeleton, a researcher can develop the operational benchmarks of the concept. (2) Content Validity The content validity of a measuring device is determined by the extent to which the contents of the measuring instrument represent all aspects considered as aspects of the conceptual framework. (3) External Validity The external validity of the instrument is tested by comparing the existing criteria of the instrument with the empirical facts occurring in the field.

Test Validity, testing the strength of the relationship (correlation) between the item score with the total variable score by using product momet correlation, if the correlation is significant then the item / item question is valid. Testing of the validity of this construction is done with one way approach (single trial). If the item is invalid then the item is discarded. Valid items used as actual questionnaires to be given to all respondents who have been determined as many as 30 people and until the instrument item is declared valid question. The formula of validity testing with product momet correlation is:

$$R_{xy=} \frac{N\sum XY-\left(\sum X\right)\left(\sum Y\right)}{\sqrt{\left\{N\sum X^2-\left(\sum X^2\right)\right\}\left\{N\sum Y^2-\left(\sum Y\right)^2\right\}}}$$

Information :

Rxy: The correlation coefficient between x and y

x: Variable x (item question)

y: Variable y (total score).

n: Number of individuals in the sample

In this research, Validity Test is used to measure whether or not a valid questionnaire is valid. A questionnaire is said to be valid if the instrument can be used to measure what should be measured. Sugiyono (2005), stated that to measure the validity of the questionnaire items is done by correlating between the questionnaire scores with the total score of the variables of each variable, with the criteria of decision making is valid instrument item if it is obtained r> 0.3. An experimental test was conducted to 30 respondents outside the sample.

Reliability is an index that indicates the extent to which a measuring device is reliable or reliable. When a measuring device is used twice - to measure the same symptoms and the measured results are relatively consistent, the gauge is reliable. Reliability fills the accuracy of measuring instruments.

A measuring instrument is said to have a high reliability or reliability, if the gauge is steady, in the sense that it is stable, dependability and predictability. A steady measuring instrument does not vary measurably and reliably because the use of the measuring instrument multiple times will produce similar results. The smaller the measurement error, the more reliable the measuring tool and vice versa.

Test Reliability. To know the concentration or belief of measuring results that contains accuracy of measurements then tested the reliability. Reliability testing is done by coefficient alpha (a) from Cronbach by Husein Umar (2007) with the formula:

$$r_{11} = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum \pm_b^2}{\pm_1^2}\right)$$

where:

r_{11} = instrument reliability

k = number of questions

$\pm_1^2$ = total variant

$\sum \pm_b^2$ = total number of variant

Reliability measurement in this research is done by one shot (one measurement only). Here the measurement of variables is done once and then the results are compared with other questions to measure the correlation between the answers to questions. A construct or variable is said to be reliable if it gives a Cronbach Alpha value> 0.60 (Ghozali 2005).

This study uses Internal Consistency Realiability where the instrument items are homogeneous and reflect the same "construct" in accordance with the underlying. At this time the widely used is to use Cronbach’s Alpha. A construct or variable is said to be reliable if it gives a Cronbach Alpha> 0.8 value of excellent reliability / very convincing, 0.7 <Cronbach Alpha <0.8 good reliability, and Cronbach Alpha <0.7 reliability is less convincing.

Path Analysis (Path Analysis)

The technique used to test the hypothesis is path analysis. The path analysis model is used in testing the magnitude of the contribution (influence) shown by the path coefficients on each path diagram of the causal relationship between X1, and Y1 to Y2. Correlation and regression analysis is the basis of path coefficient calculation. Path Analysis (Path Analysis) is done by using the steps as follows:

1. Make a structural equation, in this research there are two structural equations namely:

$Y1 = \rho yx1\ X1 + \rho yx2\ X2 + \rho y\ \varepsilon 1$

$Y2 = \rho yx1\ X1 + \rho yx2\ X2 + \rho y2y1y1\rho y\ \varepsilon 1$

Basically the path coefficient is the regression coefficient calculated from the database that has been set in the standard number or Z-score, ie the data set with the standardized path coefficient is used to explain the magnitude of the influence (not predict) the free variable (exogenous) against other variables that are treated as endogenous variables. The variables included in this study should also be tested for viewing and testing a model that is appropriate or not used in the study through the classical assumption test.

2. Describe the path analysis

Draw a complete path diagram, determine its sub-structure and formulate its corresponding structural equation of the proposed hypothesis.

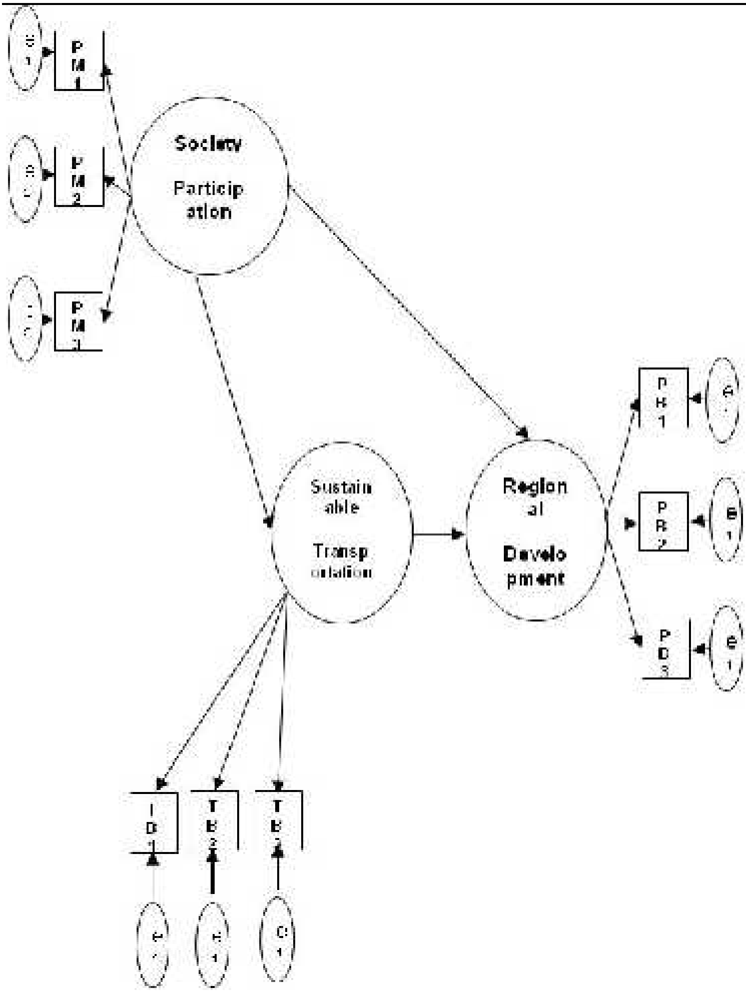

Figure 2.1 Research Thinking Framework

RESULT

Effect of community participation on sustainable transport.

Significant testing with decision-making criteria: Ha is accepted and H0 is rejected, if thitung> ttabel or Sig. t <α Ha is rejected and H0 is accepted, if t count <ttabel or Sig. t> α t count is 4,187 while ttable is 1,665 and significant is 0.000, so thitung 6,898> ttable 1,665 and significant 0,000 <0,05, hence Ha accepted and H0 rejected, which states participation partially influence on sustainable transportation.

Based on the results of path analysis indicates that the participation of the Society directly affects the development of the region and may also have an indirect effect that is from the influence of public participation on sustainable transportation (as intervening variable) then to the development of the region. The magnitude of the direct effect is 0.229, while the indirect effect must be calculated by multiplying the indirect coefficient of 0.417 x 0.568 = 0.237 or the total effect of public participation on the development of the region = 0.229 + (0.417 x 0.568) = 0.466. Since the value (P3 <P1 x P2) then sustainable transport serves as an intervening variable.

From the results obtained calculations show indirect influence through sustainable transport greater than the direct influence on regional development. These results indicate that public participation influences regional development through sustainable transport as an intervening variable, or it can be concluded that sustainable transport becomes a variable mediating between community participation in regional development. Based on this, the hypothesis of research which states that the participation of the community influence on the development of the region through sustainable transportation gets empirical support or it can be concluded the hypothesis accepted.

This society participation includes participation in decision-making meetings, participation in thought contributions, participation in investing, participation in the implementation of urban public transportation management activities and society participation in the evaluation of the implementation of urban public transport management activities. Society participation in decision making is the active involvement of the community in terms of city public transport management policy, involvement in determining the type of public transport used, involvement in determining the number of public transport, involvement in the policy of determining the distribution of the number of public transport on each route / route and involvement in the determination of the route for each type of existing transport.

Participation of the Society in the contribution of thought that is through the official or unofficial channels in terms of public transport operations, public participation in investing in public transport, participating as an operator, active involvement in conducting public transport mode and community participation in determining the transport route. Participation in relation to last sustainable transport is in the framework of evaluation. The involvement of the community in this evaluation is in the form of an opportunity to provide feedback on the management of public transport, the existence of a regular meeting forum in evaluating the performance of city public transport between the general public, managers / operators, owners of transport, government and other stakeholders. Also the need for containers in providing input or criticism as well as the existence of public transportation forums, especially for urban public transport.

Apparently from the analysis there is a significant relationship between the role of society in the management of urban public transport to sustainable transportation. This sustainability is very important in ensuring social, economic and environmental sustainability. The social sustainability of such transportation is in the framework of a sense of public convenience to obtain public transportation (angkot) in support of its daily activities, the availability of public transport in every place to serve every purpose of community travel. The current number of public transports in the city of Medan operating as many as 6,695 vehicles with the number of permit routes for 240 permits, this amount is enough to serve the needs of people who want the ease of getting the public transportation, but only uneven spread. Then guarantee the timeliness of travel, comfort in transportation, and security in using public transport.

Road condition also becomes important whether it is good enough to support the smooth operation of vehicles on the highway. Medan City with length of road in its administrative area along 3191,5 km consisting of national road, provincial road and city road, seen from road condition then in year 3,154,30 km (98,83%) in good condition, along 15.80 km (0.50%) in moderate condition, along 20.10 km (0.63%) in damaged condition, along 1.30 km (0.04%) is heavily damaged and seen from the type of surface the road that is paved is 3,017.40 km (89.16%), soil road category along the length of 58.10 km (1.82%) and not specified along 287.70 km (9.02%). From this data the road condition is good in supporting the public transportation service of the city. However, the increase of road length in Medan City is very little from the data that there is only long road extension only happened in 2010, the community participation in giving the land for the making and widening of road still not maximize this as happened at Jalan Jamin Ginting (there is still land parcel communities that have not been released until now), Cemara Street, Ngumban Surbakti Street (people still demand additional amount of land compensation fund) and others.

Distribution of public transport city that is still not evenly distributed. If seen from the number of city public transport that operates as much as 6 965 units, not to mention if based on the permit issued by the Government of Medan City more 13.866 units, which means there are 7171 units of vehicles that are allowed to be held. From this data indicates that Medan City has to take a policy of limiting the number of public transport that operates, and make policy of adjustment of public transportation (angkot) with massive bus public transportation gradually and proportionally. This means that the primary arterial roads are serviced by public transports of large buses and on collector roads served by medium bus public transport and on local roads served by small bus public transport. Furthermore, in terms of social sustainability is the sense of justice in the use of public transport, there is no difference in treatment for disabled people, children, par Economic sustainability in public transport transportation is the affordability of freight for all layers of society, the policy of limiting the number of public transport, public transportation rejuvenation in order to overcome traffic congestion on the highway. And from the side of environmental sustainability is pollution / air pollution resulting from public transportation of the city which ultimately affects the public health, the noise level is donated from the number of urban public transport and the policy of using alternative fuels in addition to fuel (gasoline and diesel).

When viewed from the test results of emissions of public transport vehicles in 2014 that the vehicle must test 90,527 units. From the test results by the Department of Transportation Medan City all vehicles tested at two test sites in Terminal Pinang Baris and Terminal Amplas all passed the test. Meanwhile, for private vehicle test conducted by Environment Agency of Medan City from the sample of 783 vehicles, 623 vehicles (79.56%) passed the emission test and 160 vehicles did not pass the emission test (20.44%). This means the sustainability of the environment in Medan city in terms of emissions test from motor vehicles is still continuous and safe. And when viewed from the ambient air quality is to know the condition of ambient air quality in a location and within a certain time by paying attention to aspects of metereology, such as wind direction, temperature, humidity, and global radiation. Based on KepMen LH. Kep-45 / Men-LH / 10/1997, on the Air Pollution Standard Index (ISPU) with 4 (four) stations located in the industrial area of Medan representing the industrial area, in the stadium park representing the city center, the terminal area and the office of the subdistrict head representing the residential area can be concluded that the result of ambient air quality measurement in Medan City is on average in the last 6 (six) months in 2015, it shows that the air quality in Medan city is still in harmless condition for health. However, the measurement of ambient air quality is of course seen as a combination of meteorology, such as wind direction, temperature, humidity, and global radiation, other tests are needed to test the air quality on the road side (on the road) . Medan does not yet have such measurement data because it does not have the equipment yet. It can be concluded based on the availability of data that public transportation transportation in Medan city if viewed from economic, social and environmental sustainability can be said still continues, of course with some important consideration which still must be paid attention by Pemko Medan as described above.ents and women to use urban transportation.

The effect of community participation on sustainable transportation in accordance with the result of path analysis (SPSS) shows the coefficient of community participation pathway (X1) to sustainable transportation (X2) of 0.5 with the value of C.R 5,431> 2.0 and prob. 0,000 <0.05, indicating a positive influence and significant community participation (X1) on sustainable transport (X2).

The influence of public participation on public transport transport also supports the existing theory. The relationship of community participation to sustainable transport is explained by A.R. Barter Tamin Raad (2000) states that sustainable transportation systems should have the following principles: Accessibility, social equity, environmental sustainability, health and safety, community participation and transparency, low cost and economical, information, advocacy, capacity building and networking .

CONCLUSIONS

Based on data analysis and discussion of research results, the following conclusions can be drawn:

a. Society participation and sustainable transportation partially and simultaneously have a positive and significant influence on the development of the region in Medan City. Participation is first through community participation in decision making in every urban public transport planning (angkot). Society participation in decision making is the active involvement of the community in terms of city public transport management policy, involvement in determining the type of public transport used, involvement in determining the number of public transport, involvement in the policy of determining the distribution of the number of public transport on each route / route and involvement in the determination of the route for each type of existing transport. Second participation through community participation in the implementation, investment and provision of public transport, such as managers / operators and owners. The third participation is the participation of the society in the evaluation of urban public transport activities. The involvement of the community in this evaluation is in the form of an opportunity to provide feedback on public transportation management, the existence of a regular meeting forum in evaluating the performance of public transportation between the public, , owners of transport, government and other stakeholders. Also the container in providing input or criticism and also the existence of public transportation forum kususnya for public transportation in the city of Medan.

b. Sustainable transportation as a mediation relationship between soceity participation and regional development in the city of Medan. The influence of sustainable transportation in this case is the transportation of public transportation city (angkot) in the city of Medan seen from several indicators that is from aspects of social sustainability, economic sustainability and environmental sustainability. Social sustainability is a sense of fairness in the use of public transport, there is no difference in treatment for the disabled, children, parents and women. Economic sustainability in public transport transportation is the affordability of freight for all layers of society, the policy of limiting the number of public transport, public transportation rejuvenation in order to overcome traffic congestion on the highway. And from the side of environmental sustainability is pollution / air pollution resulting from public transportation of the city which ultimately affects the public health, the noise level is donated from the number of urban public transport and the policy of using alternative fuels in addition to fuel (gasoline and diesel). These three indicators of sustainability of urban public transportation are the ones that helped develop the area of Medan City, its influence on the aspect of PAD, economic growth and employment.

REFERENCES

Adisasmita, Rahardjo, 2005. *Dasar – Dasar Ekonomi Wilayah,* Yogyakarta : Graha Ilmu.

Adjid, D. A. 1985. *Pola Partisipasi Masyarakat Desa dalam Pembangunan Pertanian Berencana*. Bandung: Orbit Sakti.

Arikunto, Suharsimi (2006). *Prosedur Penelitian Suatu Pendekatan Praktik,* Jakarta : PT Rineka.

A.R Barter, Tamin Raad. 2000 Cipta. *Taking Steps : A Community Action Guide to People-Centered and Sustainable Urban Transport*.

Bambang S. 2007. *Transportasi Yang Humanis Dalam* http://www.pu.go.id/bapekin/bulletin%20jurnal/bulletin%2010/bulletin10 6 html. Diakses 07 Desember 2007

Banister, D.1995.Transport and Urban Development. E & FN Spon. London.

Bentler, P.M. 1992. *Structural Equations Program Manuals*. Los Angeles, BMDP, Statistical Software.

Center for Sustainable Development. 1997. *Defenition and Vision of Sustainable Transportation,* Toronto. Canada

Cernea, M. 1988. *Mengutamakan Manusia di dalam Pembangunan.* Universitas Indonesia. Jakarta.

Cohen dan Uphoff. 1977. *Rural Development: Concept and Measures for Project Design, Implementation, and Evaluation*. New York: Cornel University

Ghozali. Imam. dan Fuad 2005. *Structural Equation Modeling: Teori, Konsep, dan Aplikasi engan Program LISREL*. Badan Penerbit Undip, Semarang.

Hadjisaroso. 1994. *Konsep Dasar Pembangunan Wilayah di Indonesia,* dalam Prima No. 8 Agustus Tahun XXIII, LP3ES. Jakarta.

Hairulsyah (2012) *; Pengaruh Partisipasi Masyarakat dalam Transportasi Berkelanjutan dan Pengembangan Wilayah di Kota Medan*. Penelitian Disertasi Program Doktor PWD, USU.

Hair, J.F., R.E. Anderson, R.L. Thatam, dan W.C. Black. 2006. *Multivariate Data Analysis With Reading*, 4th edition. Englewood Cliffs, NJ: Prentice Hall.

Joreskog, K.G., & D. Sorbom. 1996. *LISREL 8: User's Reference Guide*. Chicago: Scientific Software International, Inc.

Irawan Suhartono. 2008. Metode Penelitian Sosial. PT. Remaja Rosadakarya. Bandung

Khadiyanto, Parfi, 2007. *Partisipasi Masyarakat dalam Pembangunan Unit Sekolah Baru*. Semarang. Penerbit: Badan Penerbit Universitas Diponegoro Semarang.

Kusbiantoro, B.S. 1994. *Transportasi dan Pembangunan berkelanjutan.* Jurnal PWK. Jakarta

Matsumoto,S. 1998. Urban Transportation Options for Enhanced Accessibility and Sustainability in Indonesia. Makalah Simposium I Forum Transportasi Perguruan Tinggi Indonesia. ITB. Bandung: pp.33-42.

Ndraha, Taliziduhu, 1980, *Partisipasi dalam Pembangunan,* Jakarta, LP3ES, Sentosa, Singgih, 1998.

Ratlan Pardede dan Renhard Manurung. 2014, Analisis Jalur, Teori dan Aplikasi Dalam Riset Bisnis. Rineka Cipta, Jakarta.

Rosyidi,A. 2004. Pembangunan Kota Berkelanjutan: Belajar dari Curitiba. Jurnal Perencanaan Wilayah dan Kota. ITB. Bandung.15 (3/12): 16-31.

Sadyohutomo, Mulyono. 2008. *Manajemen Kota dan Wilayah*. Bumi Aksara : Jakarta.

_________.2004. *Statistik Non Parametrik Untuk Penelitian*. Penerbit CV Alfabeta : Bandung.

Sujana. 1992. *Methoda Statistik*. Tarsito, Bandung.

Sumatera Utara Dalam Angka, 2009.

Sutriadi. 2006. *Pengendalian Kota Besar dan Metropolitan, implikasinya terhadap Transportasi yang Berkelanjutan* dalam Kusmantoro, I.P. et.al. (Editors). Essays in Sustainable Transportation : A Handbook in Honor of Prof.Dr.BS.Kusbiantoro, KK-PPK, SAPPK ITB. Bandung Hal. 259-282.

Tamin O.Z. 2000. *Perencanaan dan Permodelan Transportasi*. Penerbit Institut Teknologi Bandung, Bandung.

Tamin,O.Z.1997. Perencanaan dan Pemodelan Transportasi. ITB.Bandung

Tamin, O.Z. 1997. *Menuju Terciptanya Sistem Transportasi Berkelanjutan di Kota Bandung.* I.P. et.al. (Editors). Essays in Sustainable Transportation : A Handbook in Honor of Prof.Dr.BS.Kusbiantoro, Bandung Hal. 1 – 31.

Tiro M. 1996. *Studi Penentuan Pilihan Moda Transportasi Tujuan Perjalanan Kerja Oleh Penduduk Jakarta Selatan.* Pascasarjana Institut Pertanian Bogor, Bogor.

Wegener,M. 1996. Reduction of CO2 Emissions of Transport By Reorganisationof Urban Activities. In Hayashi,Y. dan Roy,J. (Editors.). Transport, Land-Use and Environment. Kluwer Academic Publishers. Boston: pp.103-124.

William G. Cochran. 2010, Teknik Penarikan Sampel, Penerbit Universitas Indonesia, Jakarta.

Yamin, S. dan Kurniawan, H., 2009, *Structural Equation Modeling: Belajar Lebih Mudah Teknik Analisis Data Kuesioner dengan LISREL-PLS*, Buku Seri Kedua, Jakarta: Salemba Infotek.

FEASIBILITY ANALYSIS OF BIOGAS BUSINESS DEVELOPMENT FROM CHICKEN MANURE (CASE STUDY AT PT JATINOM INDAH FARM, BLITAR, INDONESIA)

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Abstract

Gas-based resource has been widely used by Indonesians on daily basis. As for cooking purposes, the use of gas in the form of LPG (Liquefied Petroleum Gas) that is distributed by the government has been considered as problematic due to the high price and poor distribution. On the other hand, the trend of converting to alternative energy is on the rise. Therefore, the opportunity of developing an alternative resource to replace LPG for cooking is highly demanded. Biogas is a fuel which is produced from the breakdown of organic matter such as animal manure, vegetation or sewage. Biogas is a mixture of about 60 percent methane and 40 percent carbon dioxide. The highly-flammable feature of methane can be utilized for cooking purpose. Biogas is cheaper than LPG and has a more reliable distribution channel. This paper reviews the possibility of implementing biogas-based resource from chicken manure for cooking purposes by analyzing the feasibility in a case study of biogas business development at PT Jatinom Indah Farm, Blitar Indonesia.

Keywords: Biogas, chicken manure, alternative energy.

INTRODUCTION

The rise of the price of oil and other fossil-based resources forces us to think more about alternative energies. Other than that, fossil-based resources are known to leave a high carbon footprint after being used in several industries and households. Among different technologies, solar energy is considered most effective even with regard to the environmental protection of plants. Visionaries think that biomass will probably convert solar energy best and will substitute all fossil energy resource in the future (Deublein D and Steinhauser A, 2011).

In Indonesia, the majority of the people still rely heavily on fossil-based resources especially when it comes to cooking-purposes. LPG or Liquefied Petroleum Gas is a flammable mixtures of hydrocarbon gases used as fuel in heating appliances, cooking equipment, and vehicles. In Indonesia, LPG is commonly used for cooking-purpose. In 2015, as much as 67.78% of Indonesians use LPG as their main resource for cooking (BPS-Statistics Indonesia, 2017).

The use of LPG is considered as highly problematic due to its high price and poor distribution. Among several variation of volume that comes with the tube to contain the gas, the most popular kind of LPG packaged in Indonesia is the blue 12 kilograms non-subsidized LPG and the green 3 kilograms which is subsidized by the government. Because of its cheaper price due to government subsidize, the 3 kilograms LPG is more likely to be bought by Indonesian people. This is clearly a problem because 1) the subsidized LPG is meant for family with a low income and 2) there is no fulfilling procedure that filter the buyer of this type of LPG. Therefore, the middle income or even high income Indonesians also bought it. Due to this, the government has to put in more state money to meet the demand of this product.

The 3 kilograms LPG is often complained for its unavailability in the market especially in some part of Indonesia. Indonesia is a highly archipelagic country with over than 16.000 islands. Even though to this point the government has not distribute it throughout the nation, the LPG scarcity is already happening in a lot of places in Indonesia. For example in 2016 LPG scarcity happened three times in August, September and October in places like Ciamis, Makassar and Yogyakarta. This problem of LPG scarcity is worsened by the fact that not only the low economy Indonesian is using this LPG.

One of the solution towards this issue is converting to a more reliable, cheap and yet eco-friendly resource such as biogas. Biogas is the type of gas that is produced by the breakdown of organic matter such as agricultural waste, manure, sewage or food waste (Grant and Marshalleck, 2008). Biogas is produced through anaerobic process until organic mixture contain inside extract methane and carbon dioxide. Biogas can be used when it has reached the right mixture of both elements.

Blitar regencyis located in east java, Indonesia. Blitar is popular as the central production of chicken eggs with population of laying hens of more than 15.213.000 in 2016 (DinasPeternakanJawaTimur, 2016). The process of laying hens cultivation produce a side product in the form of manure. Without a proper countermeasure, chicken manure could bring a negative effect to the surrounding environment and the chicken itself. Therefore, there should be an effective way to utilize this material in order to prevent it from doing any harm. One of the way to do that is by turning the chicken manure into biogas. The objective of this paper is to analyze the feasibility in non financial and financial aspectsby opening biogas business unit using chicken manure at PT Jatinom Indah Farm, Blitar, Indonesia.

METHODOLOGY

The research method used is business feasibility study analysis. The goal of this method is to know whether opening biogas business unit for chicken layer farmer is feasible to run. The aspects analyzed in this report are non-financial financial aspects. Non-financial aspect is consisting of marketing aspects, social and environmental aspects, technical aspects, management aspects and legal aspects while financial aspect is a set of variables that indicate whether the company is benefiting financially from the business. The variables that we analyzed are Net Present Value (NPV), NET Benefit-Cost Ratio (NET B/C), Gross Benefit-Cost (Gross B/C), Internal Rate of Return (IRR) and Payback Period, and we will analyze the sensitivity of the business using switching value.

The data collected in this paper was obtained from various sources related to the development plan for waste management unit of turning chicken manure into biogas. The type of data obtained was divided into two types, namely primary data and secondary data. Primary data obtained directly through interviews and observations. Secondary data were obtained through literature study using several references such as books, internet, scientific journals, fieldwork reports and government institutions.

RESULT AND DISCUSSION

Based on the observations made in PT Jatinom Indah Farm, there are two production system that is implemented in the company which is open house and closed house. According to the production manager of PT Jatinom Indah Farm, implementation of biogas business unit is feasible to be implemented in a house that use an open house system. This is due to the fact that the distribution of chicken manure from closed house is inefficient to do in daily basis. PT Jatinom Indah Farm has not installed a technology that allow the chicken manure to be delivered from the dropping place inside the closed house system to the outside. The table below shows the number of open house system in several locations that PT Jatinom Indah have.

Biogas is a low-grade, low-value fuel and therefore it is not economically feasible to transport it for any distance. Likewise, biogas cannot be economically trucked (Krich K *et al.* 2005). Therefore, the location of biogas plant should be relatively near human residence. Considering that chicken egg production often creates an unpleasant smell, most of the production location is placed relatively far from human residence. There are only three location that in PT Jatinom Indah that meet the distance requirement to install the biogas plant which are Gogodeso, Jabon and Sumberagung. After considering which location is suitable to open biogas business unit, the next step is to analyze the feasibility of implementing the idea through non-financial and financial aspect.

Table 1: The location of laying hens production with open house system

Location Name	Quantity of Chicken House
Belakang	10
Buntung	27
Gogodeso	15
Jabon	25
Sumberagung	19
Soso	20
Lontar	15

Source: PT Jatinom Indah Farm, 2017

Non-financial Aspect

a. Marketing aspect

The figure 1 shows that the demand for energy source used for cooking is high and increasing every year. Therefore, the potential of establishing biogas business unit is positive.

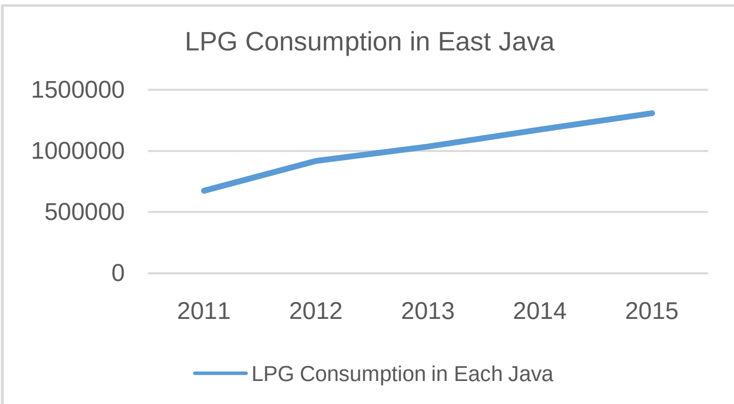
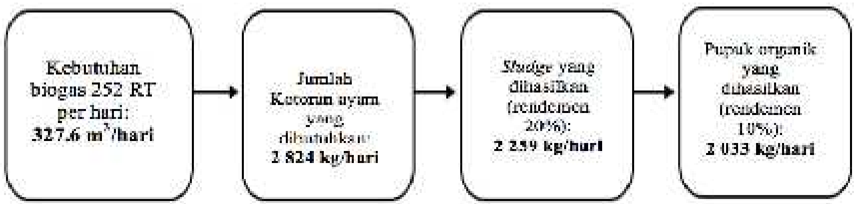


Figure 1: Demand for LPG in East Java
Source: BPS-Statistics Indonesia, 2017

Cooking is highly essential to complete day to day necessities. Therefore, the demand of energy source that is used for cooking is considered to be one of humans basic needs. The market for biogas is as wide as the market for LPG. In 2015, the number of LPG consumption in East Java is 1 307 760 Metric Ton. The picture below shows the increase of LPG consumption in East Java from 2011 to 2015.

b. Technical aspect

The number of household surrounds the three location where the biogas business development will be implemented is counted at 84 roofs for each location. Thus, the collective amount for this business development is 254 households. The average household use 1.3 m3 of biogas each day so PT Jatinom Indah Farm has to produce at least 327.6m3 of biogas every day. 1 kilogram of chicken manure can produce 0.065 – 0.116m^3 biogas (Reid, 2005). To meet that demand, the amount of chicken manure that will be use is 2 824 kilograms every day. The population of chicken in each location is more than enough to supply that demand. The process of producing biogas will create a by-product in the form of organic fertilizer. The fertilizer yield will depreciate 28% in mass compared to the mass of the chicken manure when it first inserted to the biogas plant.



c. Managerial aspect

The business development will use functional type of organization, meaning that the division will be divided according to the managerial function. Employee with the same skill set will be put in one specific division. In order to establish the biogas business unit, PT Jatinom Indah Farm will have to hire 13 more employees. 1 employee will be the field coordinator and 12 others will be spread in each location to do routine production process. In favor of gaining an appropriate social place within the surrounding community, PT Jatinom Indah Farm will hire people from around the location who are in need of having a job.

d. Collaboration Aspect

In pursuance of having a positive start, PT Jatinom Indah is required to collaborate with existing resources and institution. From the technological point of view, PT Jatinom Indah Farm can form a partnership with BIRU which stands for “Biogas Rumah” (Household Biogas). BIRU can provide insights about building a proper biogas plant as well as training the production employee on how to properly maintain the technology that is being used. From political standpoint, PT Jatinom Indah Farm can work with government through Livestock Service (DinasPeternakan) in providing the appropriate legal necessities in establishing a biogas plant.

Financial Aspect

Basic Assumptions

a. The business lifetime is 10 years.
b. The amount of discount rate that’s used is 4.5%, according to deposit rates of Mandiri Bank.
c. The price is Rp 1 600/m3 for biogas and Rp 500/kg for organic fertilizer.
d. The tax regulation that is being used refers to Constitution of the Republic of Indonesia (UUD) number 35 year 2008 on income tax, article 17 paragraph 2a. According to this regulation, the tax that should be paid is 25% of net profit before tax.

Cashflow Analysis

The result of cashflow analysis regarding to this business development plan comes with a set of variables that determines whether the business is feasible to run. The table below shows the result of the cashflow analysis.

Table 3: Feasibility variables in biogas business unit establishment

Variables	Result
NPV	Rp 1 186 604 209
NET B/C	3.045
Gross B/C	1.302
IRR	33%
Payback Period	3 years and 1 month

NPV

The NPV value for the development of this business is Rp 1 186 604 209 which means that in the assumed business lifetime, this business is able to raise Rp 1 186 604 209. The feasibility requirement for this variable is above 0 which means this business is feasibly to run.

NET B/C

The NET B/C value of this business is 3.045 meaning that for every Rp 1 of net lost from the company will bring a net benefit worth of Rp 3.045. The feasibility requirement for this variable is above 1, therefore this business is feasible to run.

Gross B/C

The Gross B/C value of this business is 1.302 meaning that for every Rp 1 cost that the company spend will bring Rp 1.302 gross benefit. The feasibility requirement for this variable is above 1, therefore this business is feasible to run.

IRR

Internal Rate of Return is a variable that shows the discount rate in which the NPV of this business is zero. If the result of this variable is above the discount rate, the business is feasible to run. The IRR value for this business development is 33% which is higher than the discount rate (4.5%). Therefore, this business is feasible to run.

Payback Period

Payback period is the amount of time in which the business is able to repay the investment cost to establish the business. A business is feasible to run if the payback period value is lower than the assumed business lifetime. The payback period for this business development is 3 years and 1 month while the assumed business lifetime is 10 years. Therefore, seeing from the payback period, this business development is feasible to run.

Switching Value Analysis

Switching Value Analysis determine to which point a business can withstand the changes in one variable. Based on the result of finding the switching value of several variables, there are two variables that is needed to be noticed, which is the decrease of demand in biogas and the decrease of chicken manure supply. The sample below shows to what point the business can tolerate these the decrease of this variables.

Table 3. Switching value result

Variables	Switching Value
Decrease of biogas demand	31.335%
Decrease of chicken manure supply	28.332%

According to the table above, the biogas business unit is able to tolerate the change in biogas demand until it reaches the decrease of 31.335%. The tolerance limits to the decrease of chicken manure supply is slightly more sensitive which is 28.332%. If the business surpass this percentage in each variables, the business with start having a deficit income.

There are several ways that PT Jatinom Indah Farm can do to prevent the changes in each variables. PT Jatinom Indah Farm should maintain a good relationship with the customer by providing them a good and fair service. Other than that, the company should pay attention to the life cycle of each house and make sure that there is no gap in which the chicken manure is not produced.

CONCLUSION

Based on the analysis into non-financial and financial aspect of this business development plan, all of the aspect meet the feasible requirement. The demand for LPG is increasing every year in East Java, in spite of the high price of LPG and its scarcity. This leads to a good potential of alternative product to replace LPG. PT Jatinom Indah Farm will distribute biogas to 254 households every day. The supply for the main ingredient in creating biogas which is animal manure is sufficient according to the production rate of chicken manure in PT Jatinom Indah Farm. Biogas business unit will hire 13 more employees, 1 person working as the field coordinator and 12 others as production worker. The coordinator will take the responsibility in making sure that the process of producing biogas runs as it planned. PT Jatinon Indah Farm can form a partnership with government and non-government institution like Biru (Biogas Rumah).

Based on financial analysis, the NPV obtained from operationas amounted was Rp 1 186 604 209 with NET B/C of 3.045, Gross B/C of 1.302 and IRR of 33%, with payback period 3 years and 1 month.The implementation of biogas business development, PT Jatinom Indah Farm should not overlook the decreasing rate of biogas demand and the decreasing rate of chicken manure supply. Based on the result from switching value analysis, biogas business unit will be able to withstand 31.335% decreasing rate of biogas demand and 28.332% decreasing rate of chicken manure. In order to make sure that the company do not ever reach this number, PT Jatinom Indah

Farm should form have a fairly good relationship with their customer. Other than that, the company should also pay attention to their chicken manure supply through the life cycle of laying hens in each location.

REFERENCES

BPS-Statistics Indonesia. 2015. Mining and Oil Statistics. www.bps.go.id

BPS-Statistics Indonesia. 2017. Households percentage according to main resource for cooking purpose. www.bps.go.id.

Deublein D, Steinhauser A. 2011. Biogas from Waste and Renewable Resources: An Introduction. John Wiley & Sons. USA.

East Java Livestock Service. 2016. Laying Hens Population in Blitar Regency. www.disnakjatim.go.id

Grant S, Marshaleck A. 2008. Energy Production and Pollution Mitigation from Broilers Houses on Poultry Farm in Jamaica and Pennsylvania. International Journal for Service learning in Engineering 3 (1): 41-52.

Krich K, Augenstein D, Batmale J, Beneman J, Rutledge B, Salour D. 2005. Biomethane from Dairy Waste, a Sourcebook for the Production and Use of Renewable Gas. Western United Dairymen. USA. 8.

Nijaguna B. 2006. Biogas Technology. New Age International. India.

Nurmalina R, Sarianti T, Uswandi AK. 2014. Business Feasibility Study. InstitutPertanian Bogor.

Reid T. 2005. The Feasibility of An On Campus Biogas Operation At The University Of Waterloo. The Royal Veterinary and Agricultural . University of Waterloo. P.1-47

Z Recebli, S Semili, M Ozkaymak, O Gonc. 2015. Biogas Production From Animal Manure. Journal of Engineering Science and Technology Vol 10, No.6.

EFFECTIVENESS BIOACUMULATION AND BIOASSAY OF HEAVY METALS (Pb, Cd, Cu, Cr, Zn) USING *Bacillus subtilis* AND *Pseudomonas aeruginosa*

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ABSTRACT

Bacillus subtilis and *Pseudomonas aeruginosa* is chemoheterotrophs bacterium that can degrade heavy metal waste that is toxic for the ecosystem, and convert it into simple compounds to be environmentally friendly. This study aims to determine the effectiveness of bacteria in remediating heavy metals as well as testing *Daphnia magna* as a polluted environmental bioindicator. The heavy metal degradation experiment is done by incubating the metal waste with bacteria, and the concentration of Pb, Cd, Cu, Zn, Cr and pH values are measured continuously every 3-4 daysby using AAS (Atomic Absorption Spectrophotometer) and pH meter. The treatments were mixed with concentration of 10 ppm, 5 ppm and 3 ppm. The sample of incubationswere tested by bioassaymethodwhich is inoculating *Daphnia magna* into the sample and calculating mortality rate of *Daphnia magna* every four minutes for 36 minutes. The results showed that bacterial inoculation was more effective in reducting all types of metal wasteon 10 ppm of waste concentration until 50 percent. Bacillus subtilis can degrade Plumbun (Pb) from 2.204 mg/L to 1.085 mg/L, Cadmium (Cd) from 2.115 mg/L to 0.789 mg/L, Chromium (Cr) from 2.237 mg/L to 1.396 mg/L, Copper (Cu) from 1.967 mg/L to 1.509 mg/L and Zinc (Zn) from 2.583 mg/L to 0.798 mg/L. The rate of effectiveness degradation waste would decrease in the lower concentration than before. Decreasing of heavy metal concentration would increase on pH value. The bioassay experiment provedthat the higher metal concentration would be tested, the higher mortality *Daphnia Magna* would be detected.

Key word :*Bacillus subtilis*,*Pseudomonas aeruginosa*,bioacumulation of heavy metals, bioassay, *Daphnia magna*

INTRODUCTION

Today, environmental pollution has occurred in various parts of the world. Damage occurs in forest ecosystems, rivers, estuaries, to pelagic ecosystems that are under the oceans caused by natural disasters and human activities. However, most of the damage caused by human activities in the form of illegal logging, large-scale fishing using bombs or trawlers, disposal of industrial waste without filtering prior to discharge into water bodies (rivers, lakes, dams, sea), and others.

The impact of environmental pollution will certainly affect the balance of the ecosystem. In the aquatic ecosystem, industrial wastes originating from factories as well as those derived from domestic activities will have a negative impact on the living creatures of macrofauna, mesofauna, or microfauna living in them. In addition, industrial waste also directly or indirectly impact on the deterioration of human health quality.

Based on data from the Ministry of Environment and Forestry (2014), about 74% of major rivers in Java do not meet the Class II Water Criteria that is used as a source of drinking water. In addition, data from monitoring results of 13 rivers flowing in 5 areas of Jakarta City showed all rivers in severe polluted condition. The same condition is also shown from the monitoring results of 78 reservoirs, lakes, or situ in Jakarta whose condition is very apprehensive (BPLHD DKI Jakarta 2017). Currently rivers and lakes have been used as storage and disposal of various kinds of waste so that the water quality decrease is very significant.

One cause of declining water quality is influenced by heavy metal contamination that is toxic to the environment and organisms. According to Alfisyahrin (2013), the concentration of lead metal (Pb) in Ciliwung river sediments reaches 7.23-8.60 mg kg-1 whereas in organisms that have habitat in Ciliwung river one of them is broom fish, the meat is found heavy metal Lead with very concentration also high is 2.42-3.45 mg kg^{-1}, the concentration has exceeded the threshold value according to SNI so it is not worth consumption.

This indicates the need for sustainable efforts in the context of controlling and preventing water pollution through technological efforts to prevent and control water pollution in accordance with Law no. 7 of 2004 on water resources, Article 20 paragraph 1 and 2 which states that the conservation of water resources is done to maintain the capacity and function of water resources so that expected water resources can be utilized efficiently and sustainably.

Improvements can be done in the form of physical, chemical, and biological treatment. Currently biological treatment by using microorganisms (bacteria, fungi, and other microfauna) proves to be more effective and environmentally friendly (environmental friendly), because it does not produce new problems after its implementation. Therefore, this method is widely developed and conducted by environmental activists, academics, companies, and governments to improve the ecosystem that has been damaged.

METHODOLOGY

The experimental design used was a factorial design with two factors. The first factor is waste type including heavy metal waste with concentration of 10 ppm (10P), 5 ppm (5P), and 3 ppm (3P); the second factor is bacterial isolate type including control treatment (Ct), bacterial inoculation of Pseudomonas aeruginosa (Pa), Bacillus subtilis (Bs), and consortium (BP) or mixing of both types of bacteria, each treatment repeated 3 times 36 experimental units. Observational data were tested with Analysis of variances (ANOVA), if treatment had real effect, then the data were tested by using Duncan Multiple Range Test (DMRT) test at $\alpha = 5\%$.

The standard curve of each type of metal used is a standard solution of metal analysis. The solution then made stock of 10 ppm as much as 250 ml. Preparation of stock solution through dilution formula (Mulyono, 2006). Based on these calculations then obtained standard solution of each type of metal to be taken from a stock solution of 2.5 ml. Then the solution was diluted using HNO3 0.5 M until it reached a total volume of 250 ml. The solution is then used to create a standard curve in AAS with a concentration of 0; 0.1; 0.2; 0.4; 0.8; 1; 2; 3; 4 ppm for Pb standard metal curve. Concentration 0; 0.05; 0.1; 0.2; 0.4; 0.6; 0.8; 1 ppm for a standard Zn metal curve. Concentration 0; 0.05; 0.1; 0.2; 0.4; 0.6; 0.8; 1 ppm for a standard Cd metal curve. Concentration 0; 0.05; 0.1; 0.2; 0.5; 1; 1.5; 2; 2.5 ppm for the Cu metal standard curve. Concentration 0; 0.2; 0.5; 1; 2; 3; 4 ppm for the standard Cr metal curve.

Bacterial isolates of Bacillus subtilis and Pseudomonas aeruginosa collections were rejuvenated on Nutrient Agar (NA) medium. The rejuvenation process is carried out in the laminar air flow to avoid contamination. Isolate collection was taken aseptically using an oose needle, etched into a sloping medium of Nutrient Agar which had hardened as a stock culture and incubated at 37oC for 24 hours. Then each bacterial isolate was grown on a tube containing the liquid medium of Nutrient Broth.

Bacillus subtilis isolate and rejuvenated Pseudomonas aeruginosa were then taken 1 ml and inserted into a reaction tube containing 9 ml of physiological solution, then shuffled using a stirer. Then, take back 1 ml of the solution and do the same until 10-6 dilution. Isolates with 10-6 dilution series to be piloted against artificial metallic waste media.

Heavy-duty artificial waste samples were made from mixing five types of waste, namely lead nitrate, cadmium nitrate, zinc nitrate, chromium nitrate, and copper nitrate. Each of the metal solutions was added as much as 40 ml into the aquabides. The metal waste is adjusted for concentration by treatment. Then the Nutrient Broth that has been cultured P. aeruginosa, B. subtilis and consortium are included in each aquabides. The ratio of the incubation solution was made to a ratio of 1: 9 between bacterial inoculation with a mixed metal solution.

Bacillus subtilis isolates and Pseudomonas aeruginosa were tested for their ability to detoxify heavy metals in aquabidated bottles containing sterile Nutrient Broth media which have already added artificial metallic wastewater. Then calculate concentrations of Pb, Zn, Cd, Cu, and Cr every 3-4 days using AAS and calculate the pH change by using pH meter.

Determination of heavy metal percentage by calculating Reduction Power (DR) according to equation (Husain and Irna, 2005):

$$\mathrm{DR} = \frac{C(a) - C(b)}{C(a)} \; x \; 100\%$$

Information :

C (a) = early concentration of heavy metals (mg / L); C (b) = The final concentration of heavy metals (mg / L); DR = Reduction power

After the sample was tested for approximately 14 days, then the rest of each sample that has been incubated will be tested further to measure the level of toxicity by using bioindicator Daphnia magna. Each sample bottle added Daphnia magna adult size of 20 tail. Then calculate the number of living Daphnia magna every 4 minutes for 36 minutes to find out the mortality rate in Daphnia magna. The sooner and more Daphnia magna is dead, it denotes the sample is still very toxic to the environment.

RESULT AND DISCUSSION

Bioremediation of Heavy Metal Waste

The inoculation of bacteria P. aeruginosa, B. subtilis and consortium (mixture of both types of bacteria) in the study resulted in a less significant degree of metal degradation. This is because the concentration of artificial metals waste that is used is 10 ppm, 5 ppm, and 3 ppm is still quite low. This is evidenced in the study of Arinda et al (2012) that bacteria B. subtilis and P. aeruginosa were able to grow on medium containing heavy metals up to a concentration of 50 mg / L with different resistance ranges for each type of heavy metal.

Each bacteria has the ability and mechanism of degrading different heavy metals. Bacteria B. subtilis belongs to a group of co-metabolite groups capable of growing and resistant under contaminated conditions by secreting extracellular polysaccharides to convert toxic compounds to non-toxic (Veen et al 1997). While P. aeruginosa in degrading heavy metals including metabolite groups that can change toxic compounds by using these toxic compounds as their food sources. According to Hughes and Poole (1991) P. aeruginosa is a gram-negative bacteria that has a more complex peptidoglycan cell wall. The polymer reactive group on the cell wall can bind metals, then the metal is transported through the membrane into the cell and a detoxification event takes place inside the cell compartment.

The process of metal degradation that occurs the same on each type of metal, namely reduction of Nitrate to Ammonium (NH_4^+). This metal degradation mechanism occurs because the enzyme nitrate reductase produced by B. subtilis and P. aeruginosa reduces Nitrate (NO_3^-) to Ammonium (NH_4^+). So that nitrate compounds are not available and ammonium can not be bound by heavy metals because it has the same valence. The ammonium is then tainted and produces a strong odor in the sample. Then, bacteria B. subtilis and P. aeruginosa secrete organic acids that are able to bind metallic elements and precipitate them, so the metal becomes unreactive and does not contaminate the surrounding environment. The difference in metal degradation ability lies in the way the bacteria bind the metal. In B. subtilis, the process that occurs is bioaccumulation where the metal ions are bound by the cell wall and into the cell through the cell transport. While P. aeruginosa process that is done is biodetoksifikasi.

Decreasing of Lead Metal Concentration (Pb)

The result of observation of Pb concentration on 10 ppm waste type stated that the treatment of bacterial inoculation of B. subtilis able to decrease the metal concentration up to 1.085 mg / L with initial concentration of 2,204 mg / L or reduction power 50,7% in 14 days. P. aeruginosa bacteria capable of reducing the concentration of Pb metal up to 1.112 mg / L with an initial concentration of 2.206 mg / L or reduction power of 49.55%. While the bacterial consortium was able to reduce the metal concentration up to 1,196 mg / L with the initial concentration of 2,221 mg / L or reduction power of 46.14% and the control treatment did not change, the concentration remained 2.2158 mg / L or the reduction power 0%. In the 5 ppm waste type, the control treatment had a starting-up concentration of 1.1106 mg / L, treatment with inoculation B. subtilis concentration decreased from 1.12 mg / L to 0.697 mg / L or reduction power of 37.73%, treatment with inoculation P. aeruginosa decreased from 1.094 mg / L to 0.686 mg / L or reduction power of 37.28% and the treatment of bacterial consortium decreased from 1,103 mg / L to 0.765 mg / L or reduction power of 30.67%. whereas in the 3 ppm waste type, the control treatment had initial and final concentration of 0.728 mg / L, treatment of B. subtilis decreased from 0.729 mg / L to 0.493 mg / L or reduction power of 32.38%, treatment on P. aeruginosa experienced decrease from 0.758 mg / L to 0.575 mg / L or reduction power of 24.17%, and the consortium treatment decreased from 0.738 mg / L to 0.509 mg / L or reduction power of 30.99%.

In the 10 ppm waste type, bacteria were able to degrade significantly until day 7. But on the day after until the day-to-14, the ability of bacteria began to look stagnant, this is because each bacteria has entered the stationary phase of the bacterial life phase where the ability of bacteria has been reduced and towards the phase of death. While on the waste type 5 ppm and 3 ppm, the two optimal bacteria degrade the metal significantly until the 4th day. The time difference the bacteria need to reach the exponential phase is closely related to the competition in each of the bacteria. The longer the incubation period, the bacterial population increases, while the available nutrients are running low. In this type of waste 10 ppm the availability of metal is very high. The lower the concentration of waste, then the competition between bacteria is higher. In the treatment of consortium where bacteria P. aeruginosa and B. subtilis mixed, its effectiveness is not maximal. This is because the competition between each bacteria to be able to degrade the metal, so the ability of cooperation between bacteria decreased.

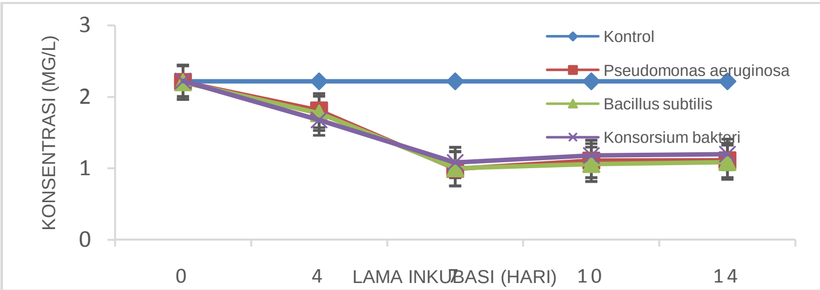

Figure 1 The curve decreasing the concentration of lead metal (Pb) in the waste type 10 ppm

Decreasing of Cadmium Metals Concentration (Cd)

The result of observation of Cd metal concentration on 10 ppm waste type stated that the inoculation of Bacillus subtilis bacteria can decrease metal concentration up to 0.789 mg / L or reduction power of 62.67% within 14 days. Pseudomonas aeruginosa bacteria can reduce the concentration of Cd metal up to 0.7053 mg / L or reduction power of 67.12%, and the bacterial consortium can reduce the metal concentration up to 0.780 mg / L or reduction power of 63.14% and the control treatment does not change, the concentration is still 2,138 mg / L or 0% reduction power. In the 5 ppm waste type, the control treatment had an initial concentration of 0.969 mg / L, the treatment with inoculation of B. subtilis decreased the concentration from 0.956 mg / L to 0.635 mg / L or reduction power of 33.56%, the treatment with inoculation P. aeruginosa decreased from 0.959 mg / L to 0.575 mg / L or reduction power of 39.99%, the treatment of bacterial consortium decreased from 0.998 mg / L to 0.652 mg / L or reduction power of 34.63%.

In addition, in the 3 ppm waste type, the control treatment had an initial and final concentration of 0.639 mg / L, treatment B. subtilis decreased from 0.625 mg / L to 0.422 mg / L or reduction power of 32.53%, treatment on P. aeruginosa decreased from 0.634 mg / L to 0.481 mg / L or reduction power of 24.08%, and the consortium treatment decreased from 0.634 mg / L to 0.494 mg / L or reduction power of 22.14%.

At 10 ppm waste treatment, B. subtilis, P. aeruginosa and consortium were able to degrade cadmium metal for 14 days. However seen in the first four days, each bacterial inoculation has not significantly degraded the metal significantly. Because, in the first four days, each bacterial inoculation in the adaptation phase of the environment is contaminated. But on the next day until the seventh day, it was seen that the bacteria treatment had entered the exponential phase. Then after that, the bacteria begin to enter the stationary phase with the reduced reduction of bacterial reduction to metals. While the treatment of waste 5 ppm and 3 ppm, curve shape almost the same shape with the activity of maximum reduction power is on the first day until the fourth day. Then, after that the bacteria enter the stationary phase is marked by the shape of the curve that is almost stagnant.

Decreasing of Chromium Metals Concentration

The result of observation of Cr concentration on 10 ppm waste type stated that the treatment of bacterial inoculation of B. subtilis could decrease metal concentration up to 1.39 mg / L with initial concentration of 2,237 mg / L or reduction power of 37.83% within 14 days. P. aeruginosa bacteria can decrease the concentration of Pb metal up to 1,585 mg / L with initial concentration of 2,282 mg / L or reduction power of 30.52%. While the bacterial consortium was able to reduce the metal concentration up to 1,616 mg / L with an initial concentration of 2,352 mg / L or reduction power of 31.3% and the control treatment did not change, the concentration remained at 2,281 mg / L or 0% reduction power. In the 5 ppm waste type, the control treatment had an initial concentration until it was fixed at 1.2565 mg / L, treatment with inoculation B. subtilis concentration decreased from 1.29 mg / L to 0.996 mg / L or reduction power of 22.75%, treatment with inoculation P. aeruginosa decreased from 1.224 mg / L to 0.935 mg / L or reduction power of 23.59% and treatment of bacterial consortium decreased from 1.267 mg / L to 0.968 mg / L or reduction power of 23.55%. In addition, in the 3 ppm waste type, the control treatment had an initial and final concentration of 0.844 mg / L, treatment B. subtilis decreased from 0.839 mg / L to 0.593 mg / L or reduction power of 29.27%, treatment on P. aeruginosa decreased from 0.839 mg / L to 0.535 mg / L or reduction power of 36.21%, and the consortium treatment decreased from 0.84 mg / L to 0.601 mg / L or reduction of 28.49%.

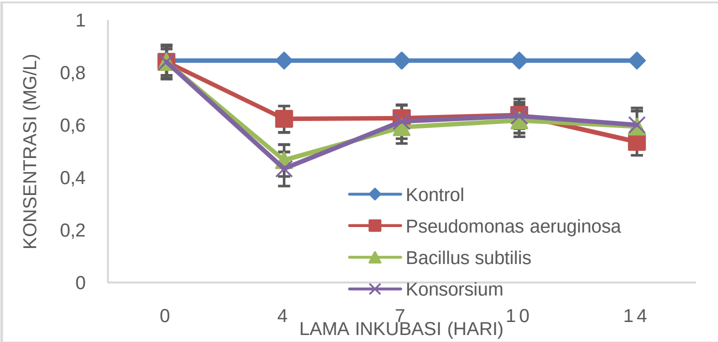

Figure 2 The chromium metal (Cr) concentration drop curve in the 3 ppm waste type

In Figure 2 the treatment of B. subtilis and consortium bacteria increased significantly after the fourth day due to bacteria reabsorption of metal compounds. This process is the release of metal compounds that have been bound because the bacteria enter the stationary phase or phase of death. when the bacteria isdead, the metal that has been bound through the intracellular process will be re-released.

Decreasing of Copper Metals Concentration

The results of observation of Cu concentration on 10 ppm waste type stated that the treatment of bacterial inoculation of Bacillus subtilis able to decrease metal concentration up to 1.509 mg / L with initial concentration of 1,967 mg / L or reduction power of 23.30% within 14 days. Pseudomonas aeruginosa bacteria can decrease the concentration of Pb metal up to 1.597 mg / L with initial concentration of 2.055 mg / L or reduction power of 22.30%. While the bacterial consortium was able to reduce the metal concentration up to 1.648 mg / L with initial concentration of 2.075 mg / L or reduction power of 20.57% and the control treatment did not change, the concentration remained at 2.067 mg / L or 0% reduction. In the 5 ppm waste type, the control treatment had an initial concentration of up to 1.032 mg / L, treatment with inoculation B. subtilis concentration decreased from 1.018 mg / L to 0.687 mg / L or reduction power of 32.43%, treatment with inoculation P. aeruginosa decreased from 1,009 mg / L to 0.715 mg / L or reduction power of 29.13% and the treatment of bacterial consortium decreased from 1,008 mg / L to 0.797 mg / L or reduction power of 20.90%. whereas in the 3 ppm waste type, the control treatment had an initial and final concentration of 0.623 mg / L, B. subtilis treatment decreased from 0.6279 mg / L to 0.5001 mg / L or reduction power of 20.35%, treatment on P. aeruginosa experienced decrease from 0.632 mg / L to 0.56 mg / L or reduction power of 11.38%, and the consortium treatment decreased from 0.6271 mg / L to 0.559 mg / L or reduction of 10.84%.

According to Nath et al. (2015) copper metal (Cu) is an essential metal for plants and plays a role in the metabolism process and required plants as micronutrients in relatively small amounts. Bacteria B. subtilis has specific cop-operon genes on plasmids and chromosomes that are able to encode bacterial resistance to Cu metals. In addition, extracellular polysaccharides that occur due to the interaction of Chromium metal with hydroxyl groups in cellulose lining the bacterial cell wall can bind copper metals and degrade them in the cell.

Penurunan Konsentrasi Logam Seng (Zn)

The result of observation of Zn concentration on 10 ppm waste type stated that the treatment of bacterial inoculation of Bacillus subtilis able to decrease metal concentration up to 0.798 mg / L with initial concentration of 2.583 mg / L or reduction power of 69.10% within 14 days. Pseudomonas aeruginosa bacteria can decrease the concentration of Pb metal up to 0.893 mg / L with an initial concentration of 2,622 mg / L or reduction power of 65.92%. While the bacterial consortium was able to reduce the metal concentration up to 0.911 mg / L with an initial concentration of 2,840 mg / L or reduction power of 67.90% and the control treatment did not change, the concentration remained 2.9003 mg / L or 0% reduction. In the 5 ppm waste type, the control treatment had an initial concentration of 0.933 mg / L, treatment with inoculation B. subtilis concentration decreased from 0.903 mg / L to 0.710 mg / L or reduction power of 21.34%, treatment with inoculation P. aeruginosa decreased from 0.923 mg / L to 0.720 mg / L or reduction power of 21.92% and the treatment of bacterial consortium decreased from 0.927 mg / L to 0.779 mg / L or reduction power of 15.90%. whereas in the 3 ppm waste type, the control treatment had an initial and final concentration of 0.601 mg / L, treatment of B. subtilis decreased from 0.626 mg / L to 0.497 mg / L or reduction power of 20.60%, treatment on P. aeruginosa experienced decrease from 0.615 mg / L to 0.586 mg / L or reduction power of 4.57%, and the consortium treatment decreased from 0.625 mg / L to 0.550 mg / L or reduction power of 12.05%.

Rate of Change pH

The observed rate of pH change on the 10 ppm waste type stated that the inoculation of Bacillus subtilis bacteria was able to increase the pH to 8.02 with the initial pH value of 2.51 within 14 days. Pseudomonas aeruginosa bacteria were able to increase the pH to 7.93 with an initial pH of 2.51. While the bacterial consortium was able to raise the pH up to 7.98 with an initial pH of 2.51 and a fixed pH value control treatment of 2.52. In the 5 ppm waste type, the control treatment had an initial pH of 2.82, the treatment with inoculation of B. subtilis pH increased from 2.82 to 8.17, treatment with inoculation of P. aeruginosa increased from 2.83 to 8.05 and treatment of bacterial consortium increased from 2.81 to 8.13. While in the 3 ppm waste type, the control treatment had an initial and final pH of 3.02, B. subtilis treatment increased from 3.03 to 8.10, treatment on P. aeruginosa increased pH from 3.03 to 7.95, and the consortium treatment increased pH from 3.03 to 8.06.

The increasing value of pH in the study sample is due to the reduced oxygen, increased NH4 + concentration, and the main source of low pH causing heavy metals. Already bound, deposited and absorbed by bacteria. On observation of pH change at 10 ppm waste, the rate of pH change has increased continuously in each day of observation. On the pH change curve, 5 ppm and 3 ppm waste types tend to flatten. This is directly proportional to bacterial activity in the treatment. The higher the reduction power, the higher the level of metal degradation by bacteria, the higher the pH will be.

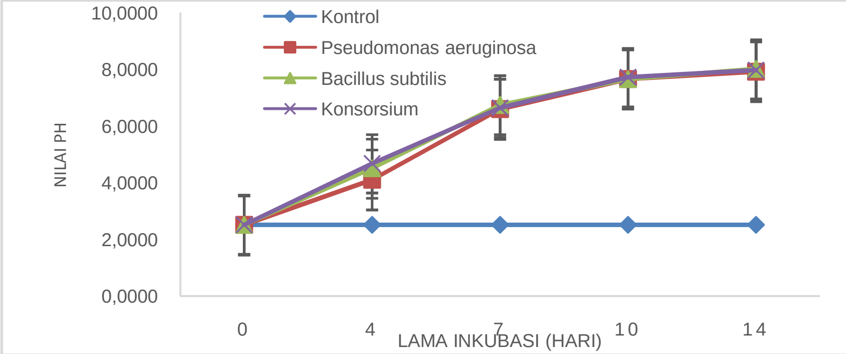

Figure 3 The pH change curve on the 10 ppm waste type

Bioassay Experiment

Observation of the sample was done on the fourteenth day, the sample was then tested further by testing bioassay using Daphnia magna. In the 10 ppm waste sample, the mortality rate of D. magna is very high. By the fourth minute, one D. magna on the control treatment (10PCt) had died and in less than sixteen minutes, twenty D. magna had died. Then in the treatment of inoculation of P. aeruginosa (10PPa), less than 24 minutes overall D. magna has died. While in the treatment of B. subtilis (10PBs) and consortium (10PBP), D. magna had an overall death of less than 28 minutes. In the 5 ppm waste sample, the highest mortality rate was found in the control treatment (5PCt) with a duration time of less than 28 minutes. While inoculation treatment of B. subtilis, P. aeruginosa and consortium average mortality time to D. magna less than 32 minutes. In the 3 ppm waste sample, the mortality rate of all treatments almost had the same mortality time, which was 36 minutes.

The results showed the higher the metal concentration, mortality rate (mortality) Daphnia magna higher also. Instead the lower the concentration of metal, the longer the Daphnia magna survives in the bottle of aquabides. Differences between bacterial treatments were not significantly different from mortality rates in each sample. However, in outline in the treatment of Bacillus subtilis bacteria, mortality rate of Daphnia magna looks lower than in the treatment of Pseudomonas aeruginosa bacteria and bacterial consortium.

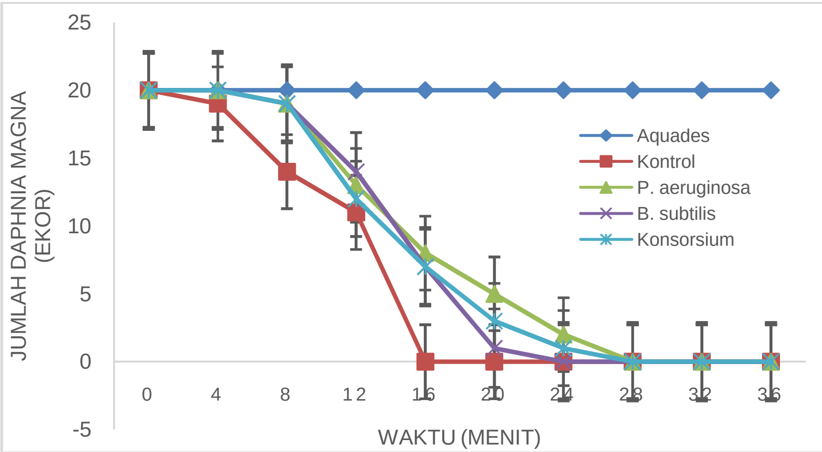

Figure 4 The mortality rate curve of Daphnia magna on waste 10 ppm

Test of Bacillus subtilis Antagonism and Pseudomonas aeruginosa

Treatment of bacterial consortium was done after Antagonism Test on B. subtilis and P. aeruginosa. Once observed, both bacteria showed a level of harmony in obtaining nutrients and energy sources. It can be seen in FIG. 27 that the sides of P. aeruginosa and B. subtilis sections are interconnected with one another and one bacterial isolate does not dominate. This is in accordance with Kim et al (2009) that bacterial isolates are antagonistic when one of the bacteria secretes polysaccharides that can inhibit the growth of other bacteria so that bacteria can utilize the nutrients freely.

CONCLUSIONS

1. Bacillus subtilis bacteria and Pseudomonas aeruginosa at 10 ppm metal waste concentration can reduce heavy metal up to 50% from initial concentration. However, at the concentration of 5

ppm and 3 pmm metal waste, all three treatments have low metal reduction capability, averaging 15-25%.

2. Pb, Cd, Cu, Cr, and Zn metal wastes are highly toxic to the environment as evidenced by the increased mortality rate of Daphnia magna with increasingly high metal concentrations.
3. The lower the concentration of heavy metals, the higher the pH value and the lower the mortality of Daphnia magna.

REFERENCES

[BPLHD] Badan Pengelolaan Lingkungan Hidup Daerah DKI Jakarta. 2017. Pengukuran Kualitas Air Sungai Ciliwung. Jakarta.

[KLHK] Kementerian Lingkungan Hidup dan Kehutanan. 2014. Statistik Kementerian Lingkungan Hidup dan Kehutanan Republik Indonesia.

[PP] Peraturan Pemerintah Republik Indonesia No. 82 Tahun 2001 Tentang Pengelolaan Kualitas Air dan Pengendalian Pencemaran Air

[UU] Undang-Undang Republik Indonesia No. 7 Tahun 2004 tentang Sumberdaya Air.

Alfisyahrin NF. 2013. Distribusi logam berat timbal (Pb) dalam daging ikan sapu-sapu (*Pterygoplichthy spardalis*) di Sungai Ciliwung. *Skripsi*. Institut Pertanian Bogor, Bogor. 20p.

Arinda T, Shovitri M, Zulaika E. 2012. *Resistensi Bakteri Bacillus Terhadap Logam Berat.* Scientific Conference of Environmental Technology IX. ISBN: 978-602-95595-5-2

Hughes MN, Poole RK. 1991*. Metal Speciation and Microbial Growth-The Hard and Soft Facts.* Journal of General Microbiology, Vol(137) 725-734.

Kim GH, Lim MT, Hur JS, Yum KJ, Koh YJ. 2009. Biological control of tea anthracnose using an antagonistic bacterium of *Bacillus subtilis* isolat d from tea leaves. *J Plant Pathol* 25:99-102.

Nath, Jayashree, Lalitagauri R. 2015. *Biosorption of Malachite Green from Aqueous Solution by Dry Cells of Bacillus cereus M1 16 (MTCC 5521).* Journal of Environmental Chemical Engineering, Vol 3(1): 386 – 394

Oktaviana B. 1995**.** Isolasi dan Karakteristik Bakteri Pengikat Merkuri Pada Perairan Sungai. *Tesis*. Program Pascasarjana Fakultas

Matematika dan Ilmu Pengetahuan Alam, Universitas Gadjah Mada.Yogyakarta.

Veen JAV, LSV Overbeek, JAV Elsas. 1997. *Fate and Activity Microorganism Introduced Into Soil.* Microbiology and MolecularBiology Review (2): 61-64.

ANALOG RICE MARKETING PROGRAM AS AN EFFORT FOR FOOD DIVERSIFICATION TO ACHIEVE ZERO HUNGER

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ABSTRACT

In addition to support the government program about food diversification, nowadays the innovation of staple food has been performed. The analog rice is the result of its innovation. Analog rice is artificial rice product made from non rice and non wheat raw material. This rice is made from mixture of shorgum, corn, mocaf, maizena, and aren sago. But, there are still a lot of question about who the target of this program. The goals of this study is to achieve a food sovereignty that realized by marketing analog rice product through cheap market concept. With literature review method and study on food issues, this study shown that food diversification program to achieve zero hunger not yet realized well. In concept and realization, the problems happen. The distortion of concept to application, lack of partnership with private sector or industry, the unequal comparison between development cost and the price of products with rice, also no sustainable and specific institution that handle the program is kind of the problems. Then, analog rice marketing program has system to collaborate with PKK and UMKM to build a cheap market. PKK and UMKM chosen because these group consisting of housewife's. With analog rice marketing program, the distribution of staple food to support government program will excellent. So, the food sovereignty happens.

Keywords: analog rice, food diversification, marketing program

INTRODUCTION

Food is an important and strategic comodity because food is the basic needs of human beings whose fulfillment becomes the basic right of every Indonesian people as stated in the Undang-Undang No 7 of 1996.

The food crisis situation experienced by various nations in the world, including Indonesia, teaches that food sovereignty should be intensified as much as possible based on national resources, because import dependence is vulnerable causing economic, social and political conflicts.

Food sovereignty is a part of basic development and strategy because no country can build their economy without solving the food problem. Especially for Indonesia, the food sector is a wider determinant of welfare, for both rural and urban populations (Welirang in Azahari, 2008)

Eventhough the food diversification program was initiated in 1974, but it has not shown the expected results (Budijanto,2014). In fact, Indonesia has great potential to produce food derived from tubers and nuts. The implementation of food diversification program is not in line with the original goal to utilizing a very rich and diverse domestic food resource. The succesful diversification program that seen is wheat-based products, such as noodles and bread. However, wheat cannot be produced properly in Indonesia (Lastinawati,2010).

The main problem of food diversification in Indonesia is the dependence of the community on rice. The problems arise due to unbalance between demand and production. Eventhough some people consume corn or sago, the average consumption still reaches 120.02kg per capita peryear in 2007 (Muttaqin and Martianto 2009).

Based on Statisticdata (2010-2014), food consumption in Indonesia has not reached the expectation because it still 64.1%. It is higher than the recommendation, 50% of total consumption intake. The high rice consumption is not only due to growth population but also the difficulty of people to consume other food. Social factors play a role in making people’s mindset, such as consuming rice has higher social status than other carbohydrate sources (cassava or tiwul). (Tarigan 2003)

Efforts to implement the food diversification in Indonesia focus on reducing rice consumption and increasing consumption of other local carbohydrate sources such as corn, sago,sorghum and tubers. Recently, It calls is analog rice (Santika, 2012). Analog rice is made from non-rice sources, having a mimicking carbohydrate content and rice-like shape(Samad, 2003; Deptan, 2011).

In 1960, the government has introduced *Beras Tekad*, which has rice like shape, made from a mixture of rice, cassava, cornstarch, and soybeans through cold extrusion process (Santika, 2012). Extrusion is a food processing that combines several processes such as mixing, cooking, kneading, shearing, and forming continously. Foodstuffs are forced to flow under the operating conditions through a mold designed to form extrusion shortly (Fellows, 2000). Unfortunately, the product did not work because it did not resemble rice and had poor quality. This indicates that development should be appropriate. In addition, the technologyandthe social feasibility should also be considered. In 2014, Budijanto found the inovative method to making the rice analogous that using hot extrusion technology. In contrast to the cold extrusion, the hot extrusion method is capable of producing rice analogous similar with rice not only the shape but also the quality.Thismethod allows to use the variety of raw materials and feasible to produce in large quantity.

Research conducted Budijanto in 2014 has succeeded in developing analog rice from various sources of carbohydrates including cornstarch, sorghum, rice, and sago. Products that show the same shape as rice, but the color is still to be developed. And analog rice has more carbohydrate content than rice (Samad, 2003).

METHODOLOGY

The methode of this study is literature review. It describes a fact through literature studies of previous studies and the existence of qualitative applications. It will be developed a marketing method that invites the contribution of several sectors of society. Assauri (2004), show that marketing strategy is basically a holistic, integrated, and unified plan in the field of marketing, which provides guidance on activities to be executed in order to achieve the marketing objectives of a company. A marketing strategy is a set of goals and objectives, policies and rules that give direction to the company's marketing efforts, at each level and reference and allocation, especially as the company responds to the ever-changing environment and competition.

This study also uses STP analysis i.e segmenting, targeting, and positioning. Segmentingis an early stage of marketing strategy. Pay attention the needs of the community, the high of rice consumption, and the benefits. It derived from geographic and demographic segmentation. The geographical segment, people who live in village and has middle to lower income. The demographic segment is housewife.

Thenext step is targeting. The main target of this program is individual consumers that use Koperasi Desa and UMKM in distribution. Then, determine the market position to occupy in the segment. The product position is the consumer's assesmen based on consumer's memory and comparison with competitor's product (Oentoro 2012). Thepromotion of this product is continuously improved through the cheap market program that held every month. This promotion involves UMKM and Koperasi Desa.

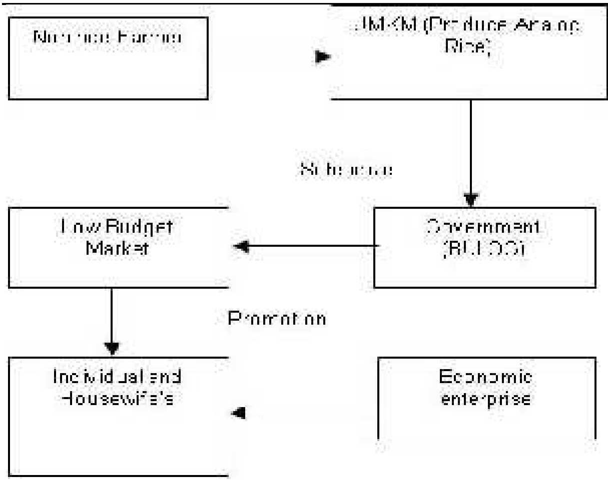

Chart 1. Analog rice's distribution pathway.

Chart 1 shows the analog rice distribution pathway. The carbohydrat sources such as cassava, sago, mochaf, and corn that produced by farmers will be sold to UMKM to produce the product. The process of analog rice according to the production pathway that has been found Budjianto in 2014. After that, this is a position where the government's role to subsidize the product. Promotion the product will be conducted to PKK or other village activities continuously.

RESULTS

The marketing strategy of analog rice products, in the framework of food diversification, with the concept of cheap market is done by government subsidy system. The government buys the analog rice from producers and distributes it in cheap price relatively. This can be done by subsidizing the marketing and profit margins. Government-subsidized marketing systems can be successful driven by the patnership between UMKM, LSM, and low-cost market programs to create sustainable distribution systems.

In the framework of continuous distribution of analog rice products, the promotion activities can be improved through electronic media such as Television and Radio, and through Ministry of Agriculture and BULOG policies. However, the cheap market program is packaged by an interesting product along and nutritional value information.

Consider to the program realization, we hope the need of food will be fulfilled.It can reduce rice imports, thus creating economic, social and political stability.

CONCLUSION

Analog rice has a nutrient content closer or equal to rice. However, the process to introduce and distribute still not optimal, so that it has not been widely known to people.The cheap market concept applied by the patnership of PKK, Koperasi Desa and UMKM. Thus, the concept of analog rice marketing will be achieved then create the economic stability.

REFERENCES

Assauri S. 2004. *Manajemen Pemasaran*.Ed ke-1. Jakarta (ID): PT Raja Grafindo Persada

Azahari, Delima Hasri. 2008. “Membangun Kemandirian Pangan dalam Rangka Meningkatkan Ketahanan Nasional”. Analisis Kebijakan Pertanian. Volume 6. No. 2bulan Juni 2008. Hal. 174 – 195

[BPS] Badan Pusat Statistik. 2014*. Produksi Beras Nasional tahun 2010-2014.*

[DEPTAN] Departemen Pertanian Republik Indonesia. 2011. Pedoman umum gerakan penganekaragaman konsumsi pangan 2011. Jakarta: Badan Ketahanan Pangan Deptan.

Fellows PJ. 2000. Food Processing Technology, Principles and Practices, @nd ed. Boca Raton. CRC Press

Oentoro D. 2012. *Manajemen Pemasaran Modern*. Yogyakarta (ID):LaksBang PRESSindo.

Samad MY. 2003. Pemuatan Beras Tiruan (*Artificial Rice*) Dengan Bahan Baku Ubi Kayu dan Sagu. J Saint dan Teknologi BPPT VII.IB.02

Tarigan H. 2003. Dilema Pangan Beras Indonesia. [terhubung berkala]. 5 Juni 2012. *http://pustaka.litbang.deptan.go.id/bppi/lengkap/st230403-1.pdf*

Martianto D, Briawan D, Ariani M, dan Yulianis M. 2009. Percepatan Diversifikasi Konsumsi Pangan Berbasis Pangan Lokal : Perspektif Pejabat Daerah dan Strategi Pencapaiannya. Jurnal Gizi dan Pangan, Vol. 4 No. 3 :123-131

THE EFFECT OF MATERIALS AND PACKAGING ON QUALITY CHANGES OF RED BEAN (*Phaseolus vulgaris L*) DODOL

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Abstract

The purpose of this study is to obtain the storage and effectiveness of a combination of poly-propylene poly (PP) and dry corn with added food ingredients of sodium benzoate preservatives, potassium sorbate and sodium propionate to the quality change of kidney bean dodol during storage. The benefits of this research are expected to provide useful scientific information about the effective use of preservatives and good packaging to improve the quality of the kidney bean dodol. The method used in this research is an experimental method that uses 2 treatments, those are (1) sodium benzoate preservative factor, potassium sorbate, potassium propionate and control (without preservatives) and (2) packaging type factor that is using polypropylene plastic and maize leaf dry with a 35-day storage period, so the experimental design using factorial randomized block design (RAK) 4x2 with 2 replication is stored at 27 °C with water content, activity fat (acid) and free fatty acid (FFA) and mold figures. The results of the analysis of red bean dodol variance on the four parameters state preservatives added and the type of packaging very significant effect on the quality of kidney bean dodol. While the combination of preservatives and packaging has no significant effect on the quality of kidney bean dodol.

Key words-Dodol; Packaging; Quality; Red bean

INTRODUCTION

According Lestari (2015), dodol is a traditional food that is quite popular that has been known since ancient times are processed in the traditional way. Nowadays dodol is better known by its original region such as dodol Garut, dodol Kudus or jenang Kudus, gelamai from

West Sumatra, dodol durian or lempok from Sumatera and Kalimatan. Dodol includes a dense and chewy semi-dense preparation product, similar products made traditionally called jenang with a more soft and oily texture. Currently dodol has been marketed more widely, especially in places of tourism with attractive packaging.

Small and medium enterprises (SMEs) today many produce innovations derived from heredity and creativity of business actors. One of them, kidney been dodol SMEs located in Dawuan Subang using product formulation and the stage of the making process is a recipe of the inheritance of karuhun which has been hereditary (Herminiati and Luthfiyanti, 2017).

According to Herminiati and Luthfiyanti (2017), the problem faced by SMEs is the storage capacity of kidney bean dodol which usually only last 2-3 weeks with marked visible mold on the surface of dodol, kidney bean dodol packaging still using plastic packaging and paper and marketed in bulk so that income from SMEs is still small. The repair solution that will be implemented is to apply standardized process technology with reference to Indonesian National Standard number 01-2986-1992, introducing appropriate technology equipment to increase production capacity and improve product packaging to increase the selling point of kidney bean dodol so that expected SMEs revenue increase.

The kidney bean (*Phaseolus vulgaris L.*) is a very popular nut commodity. According to the Central Bureau of Statistics (2014), the production of red bean in Indonesia is quite high, reaching 100,316 tons in 2014. Due to the limited utilization and short shelf life of kidney bean in the form of fresh, it needs to be processed in a sustainable way to facilitate its utilization as food ingredient (Pangastuti *et al*., 2013).

Preservatives from one side are advantageous because with the use of preservatives it can deactivate microbial life within a certain period of time. Both pathogens that can cause toxicity or other health disorders or non-pathogenic microbial that cause damage to food, such as decay. Preservatives are essentially chemical compounds that are foreign substances that enter with the food ingested. If the use of food and dosage is not regulated and supervised, it can cause health problems for those who consume it, either directly or indirectly or indirectly or cumulatively (Cahyadi, 2008).

The use of plastic for food is quite attractive because of its favorable properties such as elasticity is easily formed, has a high adaptability to the product, not corrosive like metal containers, and easy to handle. The use of plastic as a packaging is to protect the product from light, air or oxygen, heat transfer, contamination and contact with chemicals. Plastics can also reduce the tendency of food ingredients to lose some water and fat, and reduce the tendency of hardened foods (Azriani, 2006).

Maize or dried corn is a traditional packaging material that is easy to obtain, cheap and biodegradable. Dried corn leaves in Indonesia are widely used as traditional food packaging materials, including wajit Cililin typical of West Java, Bali typical dodol Denpasar, and dodol labusel typical West Sumatra. Corn leaves that can be used as packaging materials are corn leaves in a dry state. The best coating used as a dodol packaging is the middle layer of maize leaf (Setyowati et al. 2007).

METHODOLOGY

The materials used in this study are glutinous rice, grated coconut, red bean, palm sugar, granulated sugar, screwpine leaves, vanilla, salt, preservatives (to be used, among others, sodium benzoate, potassium sorbat and sodium propionate) poly propylene plastic (PP), dried corn leaves and oil paper).

The tools used in the processing of kidney bean dodol are large cauldron, stirrer, dodol stirrer, basin, coconut solvent, kidney bean grinder, knife, spoon, and baking sheet.

The treatment design carried out in this study is to store the kidney bean dodol consisting of two factors: the preservative food additive (a) and the packing type (b) which will be stored at room temperature 27 ° C. The auxiliary food additives (a) factor consists of 4 levels, those are, (a1) Control without preservatives, (a2) Sodium benzoate, (a3) Potassium propionate and (a4) Potassium sorbate. Then the packing type factor (b) consists of 2 levels, namely, (b1) Plastic poly propylene (PP) and (b2) Dried corn leaves (corn glob). Observations were conducted for 6 weeks by measuring water content, free fatty acid activity of water, and quantitative figures.

Method of analysis The water content is carried out using the gravimetric vacuum oven method, the cup to be used is first for 1 hour at 105ºC until constant, then the sample is weighed 2 g then in the oven at 70ºC with pressure of 67 mb until a constant weight was reached. Activity water (aw) is analyzed using the Smart Water Activity instrument with the principle of free water evaporation in the material. Figures of free fatty acids are analyzed by acid base titration method using 96% neutral alcohol solvent then titrated using 0.1 N NaOH using phenolphthalein indicator to the exact pink color. Figures are made using plate count method using Potato Dextrose Agar (PDA) medium with 3-5 days incubation period at 25-27ºC.

RESULTS AND DISCUSSION

There are two main parameters; those are chemical and microbiological parameters, chemical parameters such as water content analysis, activity water (aw) and free fatty acid (FFA). While the microbiological parameter is the total number of mold found in dodol products of red beans.

Chemical Parameters

a. Water content

Chemical analysis parameters on analysis of kidney bean dodol are water content. Based on the results of analysis of water content at 8 (eight) treatment of kidney bean dodol the average of water content ranged from 16.942 to 19.697. Dodol product of this research results in accordance with the provisions of Indonesian National Standard No. 01-2986-2013, where the maximum moisture content in dodol is 20%.

According to Winarno (2004), water is an important component in foodstuffs because water affects texture, appearance, and taste of food. In addition, water is also found in dried food even, such as flour and grains contain water in certain amounts.

The results of statistical analysis of the content of kidney bean dodol water on the preservative treatment and the type of packaging is very significant, while the interaction of preservatives and packaging type have real effect. The result of variance analysis can be seen in table 1.

Table 1. Results of variance analysis of kidney bean dodol water content

Source of Variance	F Value	F Table	
		5%	1%
Group (K)	38.13535434	1,943	3,143
A (Preservative)	1127.907765	1,943	3,143
B (Packaging)	158.5774617	1,943	3,143
AB	6.15281884	1,943	3,143

Data analysis in table 1 shows that the preservative, packaging type and the interaction of preservatives and packaging significantly affect the water content of kidney bean dodol. From these results it must be done further test to determine the difference of all dodol treatment of kidney bean dodol.

Table 2 Effect of preservative on water content response*)

Preservatives	Average moisture content (%)
Potassium propionate	17,18580148 (a)
Control	18,52018307 (b)
Potassium sorbate	19,57558927 (b)
Sodium benzoate	19,65922763 (bc)

*) Description: The mean values followed by different letters show a significant effect on the 5% real level according to the Duncan test.

The result of analysis in table 2 is the effect of preservative on water content response. In table 2 can be seen preservative potassium propionate significantly different to the control, potassium sorbate and sodium benzoate. While the control treatment did not differ significantly to potassium sorbate and sodium benzoate, as well as potassium sorbate and natrium benzoate The average result can be influenced by uneven level of maturity from kidney bean dodol.

Table 3 Effect of packing type on water content response*)

Package type	Average moisture content (%)
Dried Corn Leaves	18,46967829 (a)
Polypropylene	18,90695466 (b)

*)Description: The mean values followed by different letters show a significant effect on the 5% real level according to the Ducan test.

The result of analysis in table 3 is the influence of packing type on water content response. In table 3 can be seen the treatment of kidney bean dodol packed with dried corn leaves significantly different to kidney bean dodol packed using polypropylene plastic. From these results can be seen the type of packaging can affect the average levels produced during storage. The average result can be influenced by uneven level of maturity from kidney bean dodol.

Table 4 The interaction of preservatives and packaging against the water content response*)

Interaction of preservatives and packaging	Average moisture content (%)
P. propionate and dried corn leaves	17.00907 (a)
P. propionate and polypropylene	17,36253 (b)
Control and dried corn leaves	18,20372 (b)
Control and polypropylene	18.83665 (b)
P. sorbat and dried corn	19,40724 (b)
N. benzoate and polypropylene	19,45409 (b)
N. benzoate and dried corn leaves	19,69709 (b)
P. sorbat and polypropylene	19,91121 (b)

*)Description: The mean values followed by different letters show a significant effect on the 5% real level according to the Duncan test

The result of analysis in table 4 is the influence of packet preservative interaction on water content response. In table 4 can be seen% water content of P.DJ sample is significantly different with P.PP, C.DJ, C.PP, S.DJ, B.DJ, B.PP and S.PP samples. while the other samples were not significantly different based on Duncan test. The average result can be influenced by uneven level of maturity from kidney bean dodol.

b. Activity Water (aw)

Food damage that occurs in dodol is the growth of microorganisms that are affected by the level of water activity. Suitable water activity (aw) for mold growth is in the range of 0.7-0.8 (Adnan, 1981).

The result of statistical analysis of activity water (aw) of kidney bean dodol on preservative treatment and packing type is very significant, while the interaction of preservative and packing type has no significant effect. The result of variance analysis of activity water (aw) can be seen in table 5.

Table 5 Results of variance analysis of Activity Water (aw) kidney bean dodol

Source of Variance	F Value	F Table	
		5%	1%
Group (K)	3.40252	1,943	3,143
A (Preservative)	5,01676	1,943	3,143
B (Packaging)	11.0046	1,943	3,143
AB	0.53662	1,943	3,143

The data analysis in table 5 shows that the preservative and packing type is very significant effect on the activity water (aw) kidney bean dodol while the interaction of preservatives and packaging did not significantly affect the activity water (aw) kidney bean dodolFrom these results then the treatment of preservatives and the type of packaging should be tested further to determine the difference of each treatment of kidney bean dodol.

Table 6 Effect of preservatives on activity water response (aw)*)

Sample	Average activity water (aw)
Potassium propionate	0.76625 (a)
Potassium sorbate	0.77633 (a)
Control	0.77925 (a)
Sodium benzoate	0.78625 (a)

*)Description: The mean values followed by different letters show a significant effect on the 5% real level according to the Duncan test

The result of analysis in table 6 is the effect of preservative on activity water response (aw). In table 6 can be seen preservative potassium propionate, potassium sorbate, control and sodium benzoate are not significantly different. The overall Duncan test results showed the average value of preservative treatment no significant difference.

Table 7 Influence of packaging type to response activity water (aw)*)

Sample	Average activity water (aw)
Dried corn leaves	0.76988 (a)
Polypropylene	0.78068 (a)

*)Description: The mean values followed by different letters show a significant effect on the 5% real level according to the Duncan test

The result of analysis in table 7 is the influence of packing type on activity water response (aw). In table 7 can be seen the treatment of kidney bean dodol packed using dried corn leaves did not differ significantly to dodol beans packed using polypropylene plastic. From these results can be seen that both types of packaging used are not significantly different in the response activity of water (aw).

Based on the observation, kidney bean dodol reached at 0.721 until 0.802, then the value can be used mold to grow. This corresponds to the theory that the minimum limit of mold growth is at aw .70 to .80. For semi-wet food products, is the most common type of microbes are damaging mold. This is because, semi-wet food products generally have a high enough carbohydrate, which is the main nutrients needed by mold to grow.

c. Free Fatty Acid (FFA)

Good quality dodol is dodol with a texture that is not too soft, the shiny outside due to the coating of sugar or glazing, a distinctive flavor and if it contains no rancid oil. The fat contained in dodol comes from coconut milk used. Damage to fats in foodstuffs can occur during processing and during storage. According Winarno (2004), the main fat damage is the emergence of odor and rancidity. This is because fat is easy to absorb odor. Rancidity can be caused by hydrolysis or oxidation reactions.

According to Winarno (2004), hydrolysis is very easy to occur in fats with low fatty acids (smaller than C14) such as butter, palm oil and coconut oil. With the water, fat can be hydrolyzed into glycerol and fatty acids. Sudarmadji (2010), states that fatty hydrolysis results in the form of fatty acids and glycerol in which these alternating reactions can be catalyzed by acids, high temperatures and lipase enzymes.

The results of statistical analysis of free fatty acid content of kidney bean dodol on preservative treatment and packaging type were very significant, while the interaction of preservative and packing type had no significant effect. The result of variance analysis can be seen in table 8.

Table 8 Results of analysis of variance free fatty acid (FFA) kidney bean dodol

Source of Variance	F Value	F Table	
		5%	1%
Group (K)	47,38340089	1,943	3,143
A (Preservative)	11,95504332	1,943	3,143
B (Packaging)	9,706192787	1,943	3,143
AB	0.559327727	1,943	3,143

The data of analysis in table 8 shows that the preservative and the type of packaging very significant effect on free fatty acid content (free fatty acid) kidney bean dodol. While the interaction of preservatives and packaging has no significant effect on the number of kidney bean dodol mold. From these results, the preservative treatment and the type of packaging should be tested further Duncan to know the difference of each treatment of kidney bean dodol.

Table 9 Effect of preservatives on response to free fatty acid (FFA)*)

Sample	Average free fatty acid (FFA)
Potassium sorbate	0.358100955 (a)
Sodium benzoate	0.390533207 (ab)
Control	0.396345187 (bc)
Potassium propionate	0.430392355 (c)

*)Description: The mean values followed by different letters show a significant effect on the 5% real level according to the Duncan test.

The results of the analysis in Table 9 are the effect of preservatives on the response of figures using the test Duncan test. In table 2 it can be seen that potassium sorbate preservatives are not significantly different from sodium benzoate preservatives, but significantly different from potassium propionate and control. Then the sodium benzoate preservative treatment did not differ significantly to the preservative treatment of potassium sorbate and control but significantly different from potassium propionate. Then the treatment without preservatives / controls was not significantly different from potassium propionate and sodium benzoate but significantly different from the treatment of potassium sorbate preservative. The last treatment is to use potassium propionate preservatives not significantly different from controls, but significantly different from potassium sorbate and sodium benzoate.

Table 10 Effect of packaging type on response of free fatty acid (FFA) *)

Sample	Average free fatty acid (FFA)
Polypropylene	0.38590195 (a)
Dried corn leaves	0.412879981 (a)

*)Description: The mean values followed by different letters show a significant effect on the 5% real level according to the Duncan test

The result of analysis in table 10 is the influence of packing type to the response of mold figure. In table 10 can be seen the treatment of kidney bean dodol packed using dried corn leaves did not differ significantly to dodol beans packed using polypropylene plastic. From these results can be seen the type of packaging used is not significantly different from the average number of mold produced during storage.

The transmission rate of oxygen of dried corn of some varieties is so high that it is not suitable if used as an oxygen-sensitive product packaging material such as a high-fat product. A high rate of oxygen transmission will cause high oxygen through the packaging and then lead to a decrease in the quality of the product in it. Damage to products with high fat content is oxidative damage resulting in peroxides and short chain fatty acids that cause the product rancidity (Adnan, 2006).

Microbiology Parameters

a. Number of Mold

As a semi-wet food, dodol is susceptible to food damage. According Syamsir (2010), loss of quality and damage to food caused by factors such as the growth of microbes that use food as a substrate to produce toxins in the food. And physical damage by environmental factors (conditions of process and storage) or contamination of insects, as well as other bacteria

According Adnan (1981), food damage that occurs in dodol is the growth of microorganisms that are affected by the level of water activity. The appropriate water (aw) activity for mold growth is in the range of 0.7-0.8.

The result of statistical analysis of kidney bean dodol figures on preservative treatment and packaging type is very significant, while the interaction of preservative and packaging type had no significant effect. The result of variance analysis can be seen in table 11.

Table 11. The results of the analysis of variance of kidney bean dodol figures.

Source of Variance	F Value	F Table	
		5%	1%
Group (K)	37,5093113	1,943	3,143
A (Preservative)	2,32617964	1,943	3,143
B (Packaging)	7,14765601	1,943	3,143
AB	0.56587437	1,943	3,143

The data of analysis in table 11 shows that the preservative and packing type is very significant effect on the number of kidney bean dodol mold. While the interaction of preservatives and packaging has no significant effect on the number of kidney bean mold. From these results then the treatment of preservatives and the type of packaging should be tested further to determine the difference of each treatment of kidney bean dodol.

Table 12 Effects of preservatives on response to mold figures*)

Sample	Data Transformation	Average number of molds (Cfu / g)
Potassium sorbate	24,6417 (a)	1,313 × 103
Control	30.3525 (a)	1,875 × 103
Sodium benzoate	35.1748 (a)	2.581 × 103
Potassium propionate	40,5615 (a)	3,226 × 103

*)Description: The mean values followed by different letters show a significant effect on the 5% real level according to the Duncan test

The result of analysis in table 12 is the effect of preservative on the response of mold figures. In table 12 can be seen preservative potassium propionate, control, potassium sorbate and sodium benzoate did not differ significantly overall. When viewed the average yield of potassium sorbate preservatives more effectively used for dodol red beans than other preservatives. Potassium sorbate preservatives are more effective to use because they have higher optimum pH values than potassium propionate and sodium benzoate.

Table 13 Effect of packaging type on response to mold figures

Sample	Data Transformation	Average number of molds (Cfu / g)
Polypropylene	29,3489 (a)	1,533 × 103
Dried corn leaves	41,1196 (a)	2,965 × 103

The result of analysis in table 13 is the influence of packing type to the response of mold figure. In table 13 can be seen the treatment of kidney beans dodol packed using dried corn leaves did not differ significantly to dodol beans packed using polypropylene plastic. From these results can be seen the type of packaging used is not significantly different from the average number of mold produced during storage.

When compared to the minimum limit of aw for mold growth, *Aspergillus* mold, which has a minimum of 0.78 to grow, is strongly suspected to be a mold that grows in this dodol of red beans. Although no specific identification has been done, but since other types of shell require an aw greater than 0.80 to grow, the basis for assuming that *Aspergillus* is a mold that grows in taro dodol becomes stronger. When assumed, of course, mold spores need time to grow until it becomes visible visible, so the minimum aw growth must be under aw when it is visually visible.

CONCLUSIONS

Based on the statistical analysis of 4 parameters used to determine the quality change of kidney bean dodol can be known based on variance analysis test of water content, activity water (aw), free fatty acid (FFA) and mold figures have the same result where preservatives and packaging very significant effect on the four responses that become the parameters of kidney bean analysis. However, the interaction of preservatives and packaging of parameter activity water (aw), free fatty acid (FFA) and mold figures have no significant effect. While the water content response significantly.

From the average of results of research of kidney bean dodol which most optimum is used as an effective preservative based on the results of figures can be seen from the average number of molds for 35 days which has the lowest value of potassium sorbate with an average of 1.313 × 103 CFU / g, the highest value is potassium propionate with an average of 3.226 × 103 CFU / g. As for the effective packaging based on the number of mold ie polypropylene plastic with an average of 1.533 × 103 CFU / g. Based on the results of free fatty acid (FFA) the most optimum preservatives used were potassium sorbate with an average of 0.3581% for 35 days, while the optimum packaging based on free fatty acid (FFA) result is polypropylene plastic with an average of 0, 3859%. Based on the results of the optimum water content (aw) response of the optimum ingredient is potassium propionate with an average value of 0.76625 for 35 days, while the optimum packaging type based on the activity water response (aw) result is 0.76988 dry corn. Based on the results of the water content response of preservatives optimum used is potassium propionate with an average value of 17.1858%, while the optimum packaging based on moisture content is dry corn with an average value of 18.4697% only slightly different with polypropylene with value on average 18.9069%.

Recomendation in this study should pay more attention to the level of cleanliness of the room used for the production of kidney bean dodol, cleanliness of raw materials used and cleanliness of tools used. In addition, it should be appropriate in determining the level of maturity because it will greatly affect the results of research.

REFERENCES

Adnan, Mochamad. 1981. Aktivitas Air dan Kerusakan Bahan Makanan. Agritech. Yogyakarta.

Adnan, A. A. 2006. Karakterisasi Fisiko Kimia dan Mekanis Kelobot Jagung Sebagai Kemasan. IPB : Bogor

Azriani, Y. 2006. Pengaruh Jenis Kemasan Plastik dan Kondisi Pengemasan Terhadap Kualitas Mie Sagu Selama Penyimpanan. IPB : Bogor.

Badan Pusat Statistik. 2014. Statistik Produksi Holtikultura. Indonesia

Cahyadi, W. 2008. Analisis dan Aspek Kesehatan Bahan Tambahan Pangan. Bumi Aksara : Jakarta.

Herminiati, A dan R. Luthfiyanti. 2017. Prosedur Nasional Inovasi Proses Akar Rumput. PPTTG-LIPI : Subang

Lestari, D. 2015. Aktivitas Antioksidan dan Kandungan β-Karoten Dodol Labu Kuning Dengan Penambahan Bunga Kecombrang Sebagai Pengawet Alami. Universitas Muhammadiyah Surakarta : Solo

Pangastuti, A, D. R. Affandi, dan D. I. Hesti. 2013. Karakterisasi Sifat Fisik dan Kimia Tepung Kacang Merah (Phaseolus vulgaris L.) Dengan Beberapa Perlakuan Pendahuluan. Universitas Sebelas Maret : Surakarta

Setyowati, K, Adna AA, dan Sugiarto. 2007. Karakterisasi sifat fisiko kimia dan mekanis kelobot sebagai bahan kemasan J Tekno Ind Pert. IPB : Bogor

Standar Nasional Indonesia (SNI). 1992. Nomor 01-2986 Dodol. Badan Standardisasi Nasional.

Sudarmadji, S., B. Haryono, dan Suhardi. 2010. Analisa Bahan Makanan dan Pertanian. Liberty : Yogyakarta

Syamsir, E. 2010. Prinsip Pengawetan Pangan. http://id.shvoong.com/exact-sciences/1799732-prinsip-pengawetan-pangan/. Diakses pada tanggal 29 Februari 2017.

Winarno, F. G. 2008. Kimia Pangan dan Gizi. M-Brio Press : Bogor

THE INFLUENCE OF CLINICAL MASTITIS ON MILK QUALITY OF DAIRY COW

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ABSTRACT

Clinical Mastitis is an inflammation on the internal udder tissue which identified by the change of the milk quality and the udder physical condition. The purpose is to describe the influence of clinical mastitis on quality of milk produced by dairy cows. Primary data received from result of the examination of milk quality. Five milk sample were taken from healty cows and others five sample were taken from cows with clinical mastitis. Secondary data were taken from literature studies about milk production in Indonesia, standard and milk examination methods, also the etiology of mastitis. The milk that been produced had decreased in quality, such reddish, salty, and had a stench smell and also clotted. The milk has a pH above 6.75 and broke out during alcohol testing. Milk can not be used as an ingredient for processed products because it breaks easily during heating, and contains harmful antibiotic recidues when consumed.

Keywords: clinical mastitis, dairy cow, milk quality.

PENDAHULUAN

Mastitis klinis merupakan peradangan pada jaringan internal ambing yang ditandai dengan perubahan kualitas susu dan fisik ambing.Susu yang dihasilkan oleh sapi yang mengalami mastitis klinis mengalami perubahan kualitas yaitu berubah warna, bau, rasa dan konsistensi, sehingga berimbas pada penurunan keuntungan bagi peternak. Hal tersebut menjadikan pentingnya pengujian kualitas susu untuk dilaksanakan, sehingga dapat menerangkan pengaruh mastitis klinis terhadap kualitas susu yang dihasilkan. Hasil yang diperoleh, diharapkan mampu menjadi evaluasi bagi para peternak agar terlindungi dari kerugian akibat perubahan kualitas susu.

Tujuan dari penulisan ini adalah menjelaskan pengaruh mastitis klinis terhadap kualitas susu yang dihasilkan oleh sapi perah.

METODOLOGI

Pengamatan ini dilaksanakan selama satu bulan mulai tanggal 23 Januari-22 Februari 2017 di salah satu peternakan sapi perah di Bogor.

Data yang didapatkan adalah data primer dan data sekunder. Data primer diperolah dari hasil pengujian kualitas pada lima sampel susu sapi sehat dan lima sampel susu sapi mastitis klinis. Data sekunder diperoleh dari studi pustaka mengenai, standar dan metode pengujian susu di Indonesia, serta etiologi mastitis.

Metode Pengambilan Sampel Sapi

Ukuran sampel minimal pada penelitian deskriptif berjumlah minimum 10% dari populasi (Gay dan Diehl 1992). Peternakan sapi perah tersebut memiliki populasi 25 ekor sapi laktasi, sehingga diambil sebanyak 10 ekor sapi laktasi untuk dijadikan sampel. Sampel tersebut kemudian dibagi kedalam dua kriteria yaitu lima sapi sehat (*eartag* 42,49,72,1094 dan 1591) dan lima sapi yang terjangkit mastitis klinis (*eartag* 4,109,1097,1098 dan 1943). Teknik penentuan sampel dengan pertimbangan kriteria tertentu sesuai tujuan penelitian disebut metode sampling *purposive* (Margono 2004).

Metode Pengujian Kualitas Susu

Pengujian kualitas susu dilakukan guna menggolongkan kualitas susu (*milk grading*) dan mencegah penyebaran penyakit melalui susu (*milkborne disease*). Pengujian kualitas susu yang dilaksanakan yaitu uji organoleptik meliputi warna, bau, rasa dan konsistensi, uji alkohol, uji didih, uji saring, uji residu antibiotik dan mengukur tingkat keasaman (pH). Sampel susu yang digunakan berasal dari lima sapi sehat *eartag*42,49,72,1094 dan 1591, serta lima sapi yang terjangkit mastitis klinis*eartag* 4,109,1097,1098 dan 1943. Sapi-sapi tersebut diperah pada pukul 05.00-06.30 dan sampel susu diambil sebanyak 500 ml/ ekor sapi. Sampel susu dimasukan ke setiap wadah dan diberi keterangan yaitu nomor *eartag* sapi dan tanggal pengambilan. Wadah untuk menampung sampel berbahan plastik dan berpenutup.Selanjutnya, dilakukan pengujian kualitas susu terhadap sampel-sampel tersebut. Berikut merupakan uraian metode pengujian kualitas susu yang terdiri dari alat bahan yang dipergunakan dan prosedur pengujiannya.

1) Uji Organoleptik

Pengujian organoleptik merupakan pengujian yang didasarkan pada proses pengindraan. Hasil dari pengujian ini termasuk dalam penilaian subjektif, karena hasil penilaian atau pengukuran sangat ditentukan oleh panelis yang melakukan pengujian (Saleh 2004). Alat dan bahan yang digunakan untuk melakukan uji organoleptik yaitu gelas kaca, kertas putih dan sampel susu segar. Metode yang dilakukan yaitu, sampel susu dimasukan kedalam gelas dandiamati warnanya. Kemudian susu dicium secara langsung untuk mengetahui baunya. Setelah itu sampel susu dipanaskan dan dirasakan. Konsistensi susu diamati dengan cara, sampel susu dimasukan kedalam gelas, lalu gelas dimiringkan dan ditegakkan kembali. Diperhatikan bagian susu yang membasahi dinding gelas terhadap kecepatan turunnya susu serta adanya butiran, lendir atau lainnya. Alat, bahan dan metode yang dilakukan pada uji organoleptik berdasarkan standar metode pengujian kualitas susu segar menurut SNI (1998).

2) Uji pH

pH adalah derajat keasaman yang digunakan untuk menyatakan tingkat keasaman atau kebasaan yang dimiliki oleh suatu larutan (Nodstrom 2000).Alat dan bahan yang digunakan pada pengukuran pH susu yaitu gelas kaca, pH meter dan sampel susu segar. pH meter yang digunakan harus dikalibrasikan terlebih dahulu dan dipastikan pH meter dalam kondisi menyala. pH meter dicelupkan ke dalam sampel susu hingga batas yang dianjurkan. Hasil yang tertera pada layar indikator dicatat.

3) Uji Alkohol

Pengujian alkohol dilakukan untuk mengetahui kesegaran susu. Alat dan bahan yang digunakan untuk melakukan uji alkohol yaitu gelas kaca, tissu kering,*gun-tester*, sampel susu segar, alkohol 70% dan tabung reaksi. Alkohol 70% dimasukan kedalam *gun-tester*, kemudian bagian gelas penghomogen ditutup dengan menggunakan ibu jari. Sampel susu diambil menggunakan ujung *gun-tester,* lalu dihomogenkan dengan alkohol 70%. Perbandingan antara alkohol 70% dan sampel susu adalah 1:1.Terakhir diamati bagian dinding gelas penghomogen, bila terdapat butiran-butiran susu maka hasil uji alkohol positif. Alat, bahan dan metode yang dilakukan pada uji alkohol berdasarkan standar metode pengujian kualitas susu segar menurut SNI (1998).

4) Uji Saring

Penyaringan susu adalah uji kebersihan yang bertujuan untuk memisahkan benda-benda pengotor susu yang terbawa saat proses pemerahan (Soedjoedono *et al.*2005). Alat dan bahan yang digunakan untuk melakukan uji saring yaitu gelas kaca, tissu kering atau kapas, dan sampel susu segar. Pertama bagian kisi-kisi pada saringan ditutup menggunakan tissu kering atau kapas, lalu sampel susu dituangkan diatas saringan. Kemudian diamati pada bagian tissu atau kapas tersebut, bila terdapat kotoran atau butiran susu yang tersangkut maka uji saring positif. Alat, bahan dan metode yang dilakukan pada uji saring berdasarkan standar metode pengujian kualitas susu segar menurut SNI (1998).

5) *Uji Didih*

Susu yang memiliki kualitas yang tidak baik akan pecah ataupun menggumpal bila melalui proses didih. Alat dan bahan yang digunakan untuk melakukan uji didih yaitu sampel susu yang sudah disaring, termometer makanan, panci dan kompor gas. Susu yang sudah disaring, dimasukan ke dalam panci dan dipanaskan pada suhu 37^{o}C selama 3 menit. Suhususu diukur menggunakan termometer makanan. Terakhir diamati gumpalan dan permukaan susu setelah dipanaskan, bila terdapat gumpalan atau permukaan susu menjadi pecah, maka susu dalam kondisi yang rusak. Alat, bahan dan metode yang dilakukan pada uji didih berdasarkan standar metode pengujian kualitas susu segar menurut SNI (1998).

6) *Uji Residu Antibiotik*

Residu antibiotika merupakan zat antibiotika termasuk metabolitnya yang terkandung dalam susu, baik sebagai akibat langsung maupun tidak langsung dari penggunaan antibiotik. Residu antibiotik dapat dijumpai pada susu, bila pengobatan antibiotik pada hewan tidak sesuai dengan petunjuk yang diberikan, misalnya waktu henti obat tidak dipatuhi menjelang hewan akan diperah (SNI 2008). Alat dan bahan yang digunakan untuk melakukan uji residu antibiotik yaitu gelas kaca, *β-Lactam and Tetracycline Rapid Test Kit®,* pipet, dan sampel susu segar. Sampel susu segar dimasukan ke dalam wadah sampel (*microwells*) menggunakan pipet. Lalu ditunggu beberapa saat sambil digoyangkan perlahan agar sampel susu dan bubuk *lypophilized* tercampur. Kemudian wadah sampel diletakkan pada rak dan kertas indikator dimasukan ke dalam sampel, hingga batas yang ditentukan. Hasilnya akan terlihat kurang dari 6 menit.

PENGARUH MASTITIS KLINIS TERHADAP KUALITAS SUSU SAPI PERAH

Kualitas Susu yang Dihasilkan

Susu mudah tercemar mikroorganisme bila penanganannya tidak memperhatikan aspek kebersihan. Susu yang akan dikonsumsi sebaiknya memenuhi kriteria aman,sehat,utuh,halal (ASUH). Susu sebaiknya tidak mengandung atau tidak bersentuhan dengan barang atau zat yang diharamkan, tidak mengandung agen penyebab penyakit misal mikroba patogendan residu bahan berbahaya seperti antibiotik,logam berat, dan pestisida. Susu dengan kualitas baik mengandung zat gizi dalam jumlah yang cukup dan seimbang, sertatidak dikurangi atau ditambah sesuatu apa pun (Gustiani 2009). Pengujian kualitas susu dilakukan guna menggolongkan kualitas susu (*milk grading*) dan mencegah penyebaran penyakit melalui susu (*milkborne disease*). Pengujian kualitas susu yang dilakukan yaitu uji organoleptik meliputi warna, bau, rasa dan konsistensi, uji alkohol, uji didih, uji saring, uji residu antibiotik dan mengukur tingkat keasaman (pH).

1. Pengujian Organoleptik

Pengujian organoleptik merupakan pengujian yang didasarkan pada proses pengindraan. Alat dan bahan yang digunakan untuk melakukan uji organoleptik yaitu gelas kaca, kertas putih dan sampel susu segar. Hasil yang didapat yaitu, lima sampel susu dari sapi sehat menghasilkan susuberwarna putih sedikit kekuningan, bau khas aroma susu, rasa yang manis dan gurih, serta konsistensi encer atau tidak menggumpal. Susu yang berasal dari sap yang terjangkit mastitis klinis*eartag* 4,109 dan 1943 menghasilkan susu yang mengalami perubahan fisik yaitu warna susu berubah menjadi sedikit kemerahan, bau dan rasanya anyir seperti darah walaupun sudah dipanaskan, serta konsistensinya menjadi gumpalan kekuningan dan sedikit berlendir. Hal tersebut disebabkan oleh bakteri patogen yang menginfeksi jaringan dalam ambing (*deep site infection*) dan membentuk *micro absess* sehingga susu yang dihasilkan akan bercampur dengan darah dan nanah. Bakteri tersebut mampu memproduksi enzim pemecah protein yang kemudian menggumpalkan protein kasein dalam susu (Akmal dan Romita 1996).

2. Pengukuran pH susu

Alat dan bahan yang digunakan untuk melakukan pengukuran pH susu yaitu gelas kaca, pH meter dan sampel susu segar. Susu yang dihasilkan oleh lima sapi sehat memiliki rata-rata pH 6.6. Menurut SNI (2011) pH susu yang masih layak untuk dikonsumsi berkisar antara 6.3-6.8. Sapi yang terjangkit mastitis klinis *eartag* 4,109 dan 1943 menghasilkan susu dengan kisaran pH 6.8-6.9. Hal tersebut selaras dengan pendapat yang dikemukakan oleh Herendra (2009) bahwa susu yang berasal dari sapi penderita mastitis memiliki pH diatas 6.75 atau lebih alkalis.

3. Pengujian Alkohol

Alat dan bahan yang digunakan untuk melakukan uji alkohol yaitu gelas kaca, *gun-tester*, tissu kering, sampel susu segar dan alkohol 70%. Susu yang dihasilkan oleh lima sapi sehat tidak pecah, setelah dilakukan uji alkohol. Menurut SNI (2011) syarat susu yang layak dikonsumsi yaitu negatif uji alkohol 70%. Susu sapi terjangkit mastitis klinis *eartag* 4,109 dan 1943 pecah saat direaksikan dengan alkohol 70%. Hal tersebut terlihat dari butiran susu yang menempel pada dinding tabung.Perubahan fisik susu menyebabkan kestabilan protein menurun. Kestabilan sifat koloidal protein susu tergantung pada selubung air yang menyelimutinya. Alkohol memiliki daya dehidrasi yang akan menarik gugus H^+ dari ikatan mantel air protein, sehingga protein dalam susu yang sudah rusak akan melekat satu dengan yang lain dan terbentuk butiran-butiran susu (Sudarwanto 2005).

4. Pengujian Saring

Alat dan bahan yang digunakan untuk melakukan uji saring yaitu gelas kaca, tissu kering atau kapas, sampel susu segar. Susu yang dihasilkan oleh lima sapi sehat tidak terlihat adanya gumpalan susu maupun kotoran. Sapi terjandkit mastitis klinis *eartag* 4,109,dan 1943 terlihat adanya gumpalan susu yang berwarna putih kekuningan. Menurut Subronto (2003) sapi yang terjangkit mastitis klinis akan menghasilkan susu yang bercampur dengan endapan atau jonjot fibrin ,darah, nanah maupun gumpalan protein.

5. Pengujian Didih

Alat dan bahan yang digunakan untuk melakukan uji didih yaitu sampel susu yang sudah disaring, termometer makanan, panci dan kompor gas. Susu yang dihasilkan oleh lima sapi sehat tidak pecah seteleh dilakukan pemanasan. Menurut Hidayanto (1987) susu dengan kualitas yang baik tidak akan pecah saat dilakukan pemanasan seperti pasteurisasi.Susu yang dihasilkan oleh sapi terjangkit mastitis klinis *eartag* 4,109 dan 1943 pecah setelah dilakukan pemanasan, sehingga susu tersebut tidak masuk dalam kriteria kelayakan susu, sehingga tidak dapat dikonsumsi atau diolah menjadi produk susu.

6. Uji Residu Antibiotik

Alat dan bahan yang digunakan untuk melakukan uji residu yaitu gelas kaca, *β-Lactam and Tetracycline Rapid Test Kit®,* pipet, dan sampel susu segar.Susu yang dihasilkan oleh lima sapi sehat tidak mengandung residu antibiotik, karena sapi tersebut tidak mendapatkan pengobatan dengan antibiotik. Sapi yang terjangkit mastitis mendapatkan pengobatan antibiotik, namun dengan waktu pemberian yang berbeda. Antibiotik yang diberikan yaitu *pencillin-streptomycin* dan *kanamycin*. Masing-masing antibiotik tersebut memiliki *withdrawl time* yang berbeda, residu antibiotik *pencillin-streptomycin* akan bertahan selama tiga hari dalam susu, sedangkan residu antibiotik *kanamycin* akan bertahan selama empat hari dalam susu. Sampel susu sapi yang terjangkit mastitis klinis *eartag* 4,1097,1098 dan 109 tidak mengandung residu antibiotik β-Lactam and tetrasiklin. Hal tersebut disebabkan oleh waktu pemberian obat pada keempat sapi dilakukan dua minggu sebelum pengujian residu antibiotik, sehingga susu yang dihasilkan oleh sapi-sapi tersebut tidak mengandung residu antibiotik. Sapi *eartag* 1943 merupakan sapi yang paling parah terjangkit mastitis klinis sehingga pengobatan antibiotik pada sapi tersebut, lebih sering dilakukan daripada sapi lainnya. Pengobatan antibiotik pada sapi *eartag* 1943 terakhir dilakukan dua hari sebelum pengujian residu antibiotik, sehingga didalam susunya masih terdapat residu antibiotik β-Lactam.

SIMPULAN DAN SARAN

Mastitis klinis menyebabkan penurunan kualitas susu meliputi warna kemerahan, terasa asin dan berbau amis, serta menggumpal. Susu tersebut memiliki pH diatas 6.75 dan pecah saat dilakukan pengujian alkohol. Susu tidak dapat dijadikan sebagai bahan untuk produk olahan karena mudah pecah saat dilakukan pemanasan, serta mengandung residu antibiotik yang berbahaya bila dikonsumsi.

Saran untuk peternakan tersebut yaitu melakukan deteksi dini terhadap infeksi mastitis dengan menggunakan pereaksi IPB-1 dan mengobati sapi yang sudah terjangkit mastitis pada masa kering kandang agar lebih efektif dan menghindari adanya residu antibiotik pada susu.

DAFTAR PUSTAKA

Akmal A, Romita A. 1996. Isolasi mikroba tanah penghasil antibiotika dan sampel tanah pada lokasi penumpukan sampah. *Cermin Dunia Kedokteran* 108:45-50.

Herendra. 2009. Pengaruh proses distribusi terhadap peningkatan angka kuman pada susu sapi segar di peternakan ram kecamatan mojosongo Kabupaten Boyolali. Surakarta (ID): Fakultas Kedokteran Universitas Sebelas Maret.

Hidayanto K, Edwads R, Fleet G, Wooton M. 1987. *Ilmu Pangan*. Yogyokarta (ID): Gadjah Mada University Press.

Margono. 2004. Metodologi pendidikan. Jakarta (ID): Rineka Cipta

[SNI] Standar Nasional Indonesia. 2011. Susu segar bag 1: Sapi 01-3141.1. Jakarta (ID): Badan Standarisasi Nasional Indonesia.

Subronto. 2003. *Ilmu Penyakit Ternak*. Yogyakarta (ID): Universitas Gadjah Mada Press

Sudarwanto M. 2005. Bahan kuliah higiene makanan [bahan ajar]. *Bagian Penyakit Hewan dan Kesehatan Masyarakat Veteriner*. Bogor (ID): Fakultas Kedokteran Hewan, Institut Pertanian Bogor.

Sudarwanto M, Sudarnika E. 2008. Hubungan antara pH susu dengan jumlah sel somatik sebagai parameter mastitis subklinik. *Med Vet:* 107-113

HUMAN RESOURCES INFORMATION SYSTEM FOR VOCATIONAL EDUCATION PROGRAM, HALU OLEO UNIVERSITY: IMPLEMENT BY MODEL VIEW CONTROLLER CONCEPT

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Abstract

This paper discusses the development of human resource information system for vocational education program, Halu Oleo University. The system was built using the water fall method, and then implemented by Model view controller (MVC) concept on Yii2 framework. We also discussed the use of applications that help manage human resource administration. Especially for the purpose of presentation of information at the time of study program accreditation. The built system is able to provide factual information about the state of human resources. Implementation of the beta application in the department of Architecture D3 PPV-UHO also play a role in the evaluation of system requirements in the future.

Key Word: HRIS, PPV-UHO, MVC

INTRODUCTION

Information systems become vital data infrastructure for every organization. This is because the need for data and information that can be accessed at any time by each level can transformdata into information. In addition, the implementation of information systems can improve the capacity of the organization itself. As an example of accreditation of study programs conducted by the BadanAkreditasiNasionalPerguruan Tinggi (BAN-PT), the availability of information systems used by the study program has more points compared to management using manual method.

Azad (2012), Tosun (2016), and Issa-Salwedkk. (2011) stated that there are several things that affect the successful implementation of information systems, namely managerial commitment, human resources capacity, financing support. The Vocational Education

Program of Halu Oleo University has a commitment to implement the information system in the process of managing the study program. This is reflected by the establishment of Unit TeknologiInformasiPPV-UHO which has the task of identifying information system needs and gradually incorporating the information system components in organizational management.

Some of the information systems that organizations use to improve organizational capacity include Ma and Wang (2016) using the Internet of Things Technology approach to build an Enterprise Information Management System Integration. Tahvildarzadeh, et al. (2017) identifies the quality of data so as to produce information and knowledge useful to the organization and support decision making.

The stages of building an information system are done by analyzing the organization's business processes and transforming them into databases designed and implemented a measured Structure Query Language (SQL) (Van der Heijden, 2009 and Pressman, 2010). This becomes the foundation in producing an information system that has quality and in accordance with the needs of users.

Van der Heijden (2009) and Pressman (2010) and M Abu (2014) stated that the waterfall method can be used to build an information system. This paper discusses the development of human resource information system for Vocational Education Program, Halu Oleo University. The system was built using the waterfall method, and then implemented by Model View Controller (MVC) concept in the Yii2 framework. We also discussed the use of applications that help manage human resource administration. Especially for the purpose of presentation of information at the time of study program accreditation. The built system is able to provide factual information about the state of human resources. Implementation of the beta application in the department of Architecture D3 PPV-UHO also play a role in the evaluation of system requirements in the future.

LITERATURE REVIEW

A. *Information Sistem*

The Information System is a set of human entities, technological tools, media, procedures and controls that are related to the purpose of organizing important communication networks, the process of certain routine transactions, assisting the executive management and providing data for decision support supporters (Nash, 1989).

B. *Web-based application and MVC Concept*

Web-based application or often called "WebApps" is a computer software application that uses the three-tier architecture method, where to access the database required client applications and application servers in performing its function (Greenspan & Bulger, 2001). Briefly explained that WebApps is a collection of links that refer to the information provided in the form of text or images. Since the launch of Web 2.0, WebApps has not only consisted of stand-alone application features but has integrated database technology and has become a necessity for business, science, and engineering (Pressman, 2010).

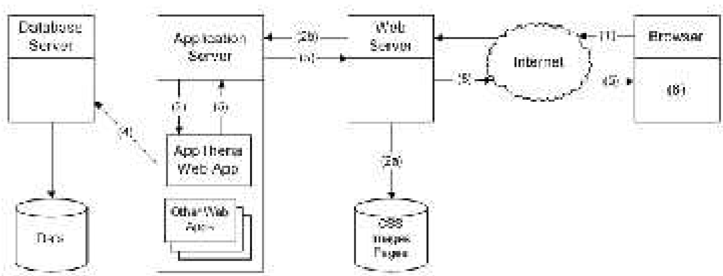

Figure1. Web Application Architecture (Alex, 2014)

Figure 1 illustrates the workings of web-based applications. The work process between the client, server and programming language module in the next request to send back the results of the request in the form of HTML displayed in the browser.

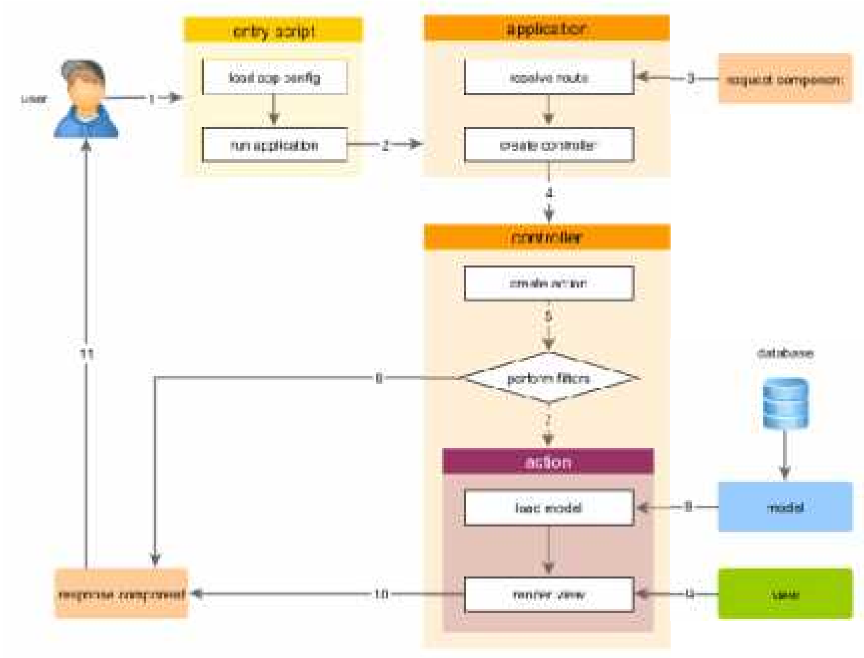

Figure 2. MVC Concepts(http://www.yiiframework.com/)

Figure 2 shows the flowchart of the use of the MVC concept in an information system. A user in accessing a database requires a controller as a link.

METHODOLOGY

The methodology used to create this information system is a waterfall model including requirements analysis and definition, system and software design, implementation and unit testing, integration and system testing, and operation and maintenance. System testing is done by blackbox method, features of information systems that have been made (Pressman, 2010). According to Ian (2011) the main stages of the waterfall model directly reflect basic development activities. There are 5 stages in the waterfall model, namely (1) Requirements Analysis and Definition: (2) System and Software Design: (3) Implementation and Unit Testing: (4) Integration and System Testing: (5) Operation and Maintenance:

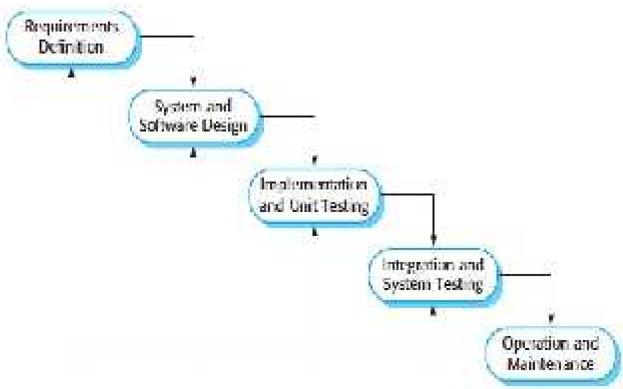

Figure 3 Waterfall Model (Ian, 2011)

RESULT AND DISCUSSION

a. System design

System design in this research using modeling language Unified Modeling Language (UML). UML is a modeling tool for visualizing, identifying specifications, building, and documenting the software system in detail. UML consists of usecase diagrams, sequence diagrams, activity diagrams and ER-Diagram (Gomaa, 2011).

Use case diagram

Figure 4 shows the Use case diagram of the Human Resources Information System for Vocational Education Program. The actor consists of employees of the administrator. Employees can update the data rank, education. Administrators can view a summary of employee circumstances.

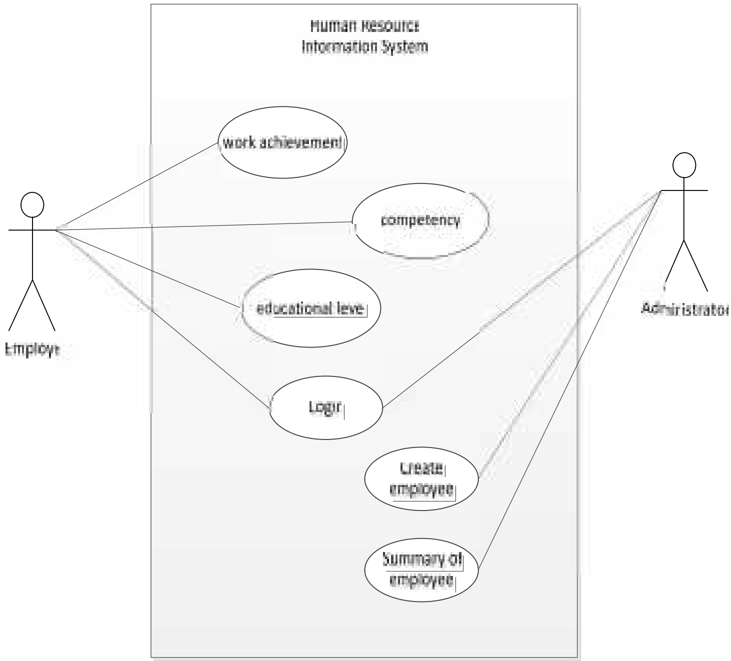

Figure 4. *Use case diagram*

ER-*Diagram*

ER-Diagram is designed using MySQL Workbench 6.3 CE software. This application is very helpful database design process, especially when doing relationships between entities. In addition, the transformation from ER-Diagram to structured query language (SQL) is easily done. Figure 5 shows the ER-Diagram of the information system

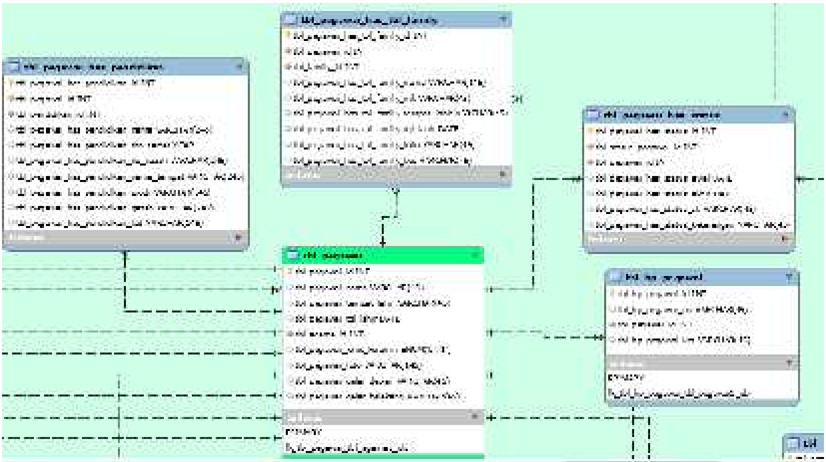

Figure 5. *ER-Digram*

b. Application development

Application development for this project is NetBeans IDE 8.2. This IDE is very helpful, for example: project file management, auto complete script and detecting script errors. In addition, the team feature integrated with github.com is very helpful in the process of program documentation.

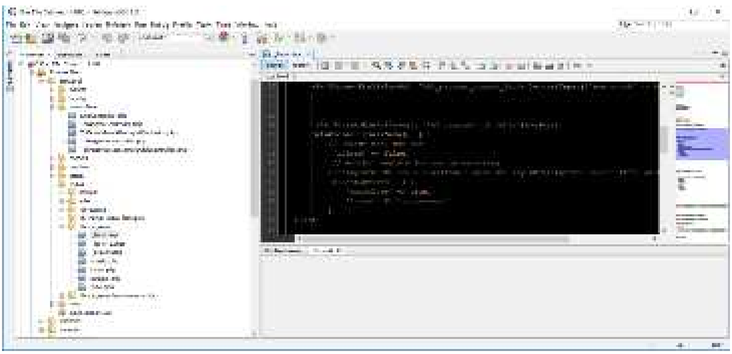

Figure 6. Application development using NetBeans IDE 8.2

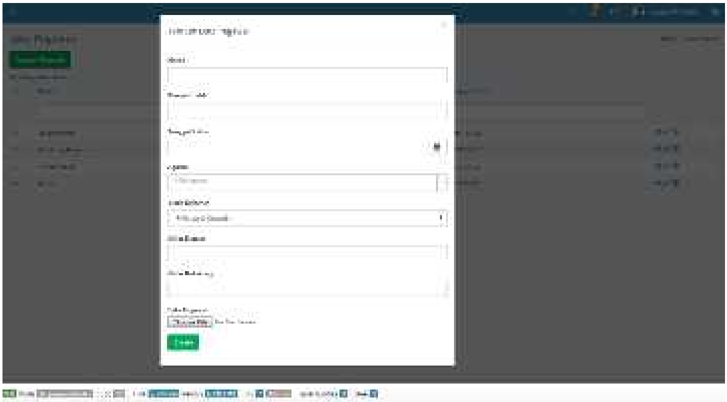

Figure 7. Input Form

Figure 7 shows one form generated from the application of the MVC concept. The use of the MVC concept greatly facilitates application development. Creating CRUD applications is so fast that it can streamline development time.

c. System Testing

System testing using black box techniques, namely by testing each functionality of the system features that have been made according to the design. Table 1 shows a summary of some of the features tested.

Table 1. Test result

Function	Test Procedure	Test Result
Login	The administrator enters the username and password	succeed
Create Employee	Administrator click the create button then fill the form and submitted	succeed
Update Employee	Administrators click on Update button then fill out the form and Update	succeed
Edit Employee	Administrator click the edit button then fill the form and edit	succeed
Delete Employee	Administrator click the delete button then confirmed the action and delete	succeed

CONCLUSIONS

We are able to apply the MVC concept to the Human Resources Information System for Vocational Education Program, Halu Oleo University. In the application testing process in Architecture D3 Program, we got a lot of enter the application development of the future. Such as data integration with existing system at Halu Oleo University. Our next research will focus on the data integration.

REFERENCES

Alex, 2014, 5 Web Application Architecture Resources for Studying. [Online] Available: http://codecondo.com/web-application-architecture/. [Accessed: 09-May-2017]

Azad, M. M., Amin, M. B., & Alauddin, M. (2012). Executive information system. *International Journal of Computer Science and Network Security (IJCSNS),12*(5), 106-110. Retrieved from http://search.proquest.com/docview/1462045210?accountid=38628

Gomaa, H. 2011. *Software Modeling & Design: UML, Use Case, Patterns, and Software Architectures*. Cambridge University Press.

Issa-Salwe, A., Sharif, L., & Ahmed, M. (2011). Strategic information systems planning as the centre of information systems strategies. *International Journal of Research and Reviews in Computer Science, 2*(1), 156-162. Retrieved from http://search.proquest.com/docview/1013807173?accountid=38628

M Abu, M.,M. (2014). Developing new methods in designing management information systems to solve management problems by using classical approach. *International Journal of*

Computer Applications, 101(16) doi:http://dx.doi.org/10.5120/ 17774-8912

Nash, J. F. 1989. Accounting System Information, Macmillan Press Ltd, New York.

Pressman, R. S. 2010. *Software Engineering: A Practitioner's Approach, Seventh Edition*. by McGraw-Hill, New York, USA.

Running Applications, http://www.yiiframework.com/doc-2.0/guide-start-workflow.html

Sommerville, Ian. 2011. Software Engineering. 9th Edition. America : Pearson Education ,Inc

Tosun, H. (2016). IT management in policing: Main advantages and disadvantages of IT for police managers. *European Scientific Journal, 12*(9) Retrieved from http://search.proquest.com/ docview/ 1779366465?accountid=38628

Van der Heijden, H. 2009. *Designing Management Information Systems*. Oxford University Press.

COMPARISON BETWEEN EUCLIDEAN AND MAHALANOBIS DISTANCE TO IDENTIFY THE MEANING OF INFANT CRIES

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ABSTRACT

In this paper, we focused on a comparison method. This research aims to compare the use of a minimum distance of Euclidean and Mahalanobis to identify infant cries and to determine the correct classification percentage for both distance.This system uses MFCC as feature extraction and codebook as feature matching. The accuracy itself used the distance of euclidean which is about 37% to 94%. The highest accuracy can be reached only if the frame length=440, overlap frame=0.4, and k=18 with a 94% accuracy. Meanwhile the value of accuracy is from the use of mahalanobis distance which is from 9% to 83%. This highest accuracy is reached when the frame length=275, overlap frame=0.25, and k=17. However, the research using distance of mahalanobis is more stable because there is a variant divider in mahalanobis distance. When the distance of euclidean is used, the accuracy of the observation result will be higher when the cluster is low, meanwhile the accuracy for the training data is better when the cluster is high. This result is different compare to mahalanobis distance. When k>9, the accuracy using the training data is higher compare to the testing data.

Keywords: *Euclidean, Mahalanobis, Dunstan Baby Language, Infant cries, K-means clustering, MFCC*

INTRODUCTION

The research of infant cries identification using codebook for pattern identifier and MFCC for feature extraction is successfully made with an accuracy of 94%. The type of infant cries identification uses the shortest distance of Euclidean (Renanti*et al.* 2013). The research can identify five kinds of baby language in Dunstan Baby

Language(DBL)version which are; “neh” means hunger, “owh” means tired which indicates that the baby starts to get sleepy, “eh” means want to burp, “eairh” means in a sore (sort of gas) in the stomach, and “heh” means uncomfortable (can be because of a wet diaper, temperature is too hot or cold, or anything else)Dunstan (2006). This research is to compare the distance between Euclidean and mahalanobis to identify infant cries. The calculation of mahalanobis distance is based on the correlation between variable and different pattern that can identify and analyze build upon the reference point.

The research concerning the different of the distance between these two is done to several problems such as: study of face authentication using euclideanandmahalanobis distance classification method. The result of this research concludes that mahalanobisdistance is a metric better adapted than the usual euclidean distance and it involves non spherical symmetric distributions. It increases the quality of image reconstruction (Brindha*et al.* 2017). The other research is on sample weightedclusteringalgorithmusing euclidean and mahalanobis distances. The result of the research is different from the previous one which isthek-means algorithm using euclidean distance with proposed centroid converged in 12 iterations with 82.8% and mahalanobis distance converged in 11 iterations with 75.3% are correct classification (Deepana 2017).

The two previous research showed a different result, the first one is better to use the mahalanobis distance, the second one is better to use the Euclidean distance. This research aims to compare the distance between Euclidean and mahalanobis to identify infant cries in Dunstan Baby Language version and to determine the correct classification percentage when using the Euclidean and mahalanobis distances. Later on, the result can be used as a comparison to the previous result and to decide a better result when identifying infant cries.

METHODOLOGY

The methodology used in this research is shown in Figure 1. The difference of this methodology with the previous one is located exactly on testing and analyzing. This research is focusing on the minimum use of Euclidean and mahalanobis distance to identify the type of infant cries.

The data is taken from Dunstan Baby Language videos that has been processed.The data is divided into two, training data and testing data. There are 140 training data, each of which represents the 28 hungry infant cries, 28 sleepy infant cries, 28 wanted to burp infant cries, 28 in pain infant cries, and 28 uncomfortable infant cries (could be because his diaper is wet/too hot/cold air or anything else). The testing data is 35, respectively 7 infant cries for each type of infant cry.

This system uses MFCC as feature extraction and codebook as feature matching. The codebook of clusters is made from the proceeds of all the baby's cries data, by using the k-means clustering. The identification of this type of infant cries uses the minimum distances of Euclidean and mahalanobis.Every cluster is representated by code vector ci that is centroid. Code vector compilation result is called codebook. This codebook as a speaker model (Linde*et al.* 1980).

The pseudo code of the *k*-means algorithm is to explain how it works (Abbas 2008):

A. *Choose K as the number of clusters*
B. *Initialize the codebook vectors of the K clusters (randomly, for instance)*
C. *For every new sample vector:*
   - C.1 *Compute the distance between the new vector and every cluster's codebook vector.*
   - C.2 *Recompute the closest codebook vector with the new vector, using a learning rate that decreases in time*

Speech input distance with codebook is formulated as follows:

1 For each frame of the incoming speech input, the distance to every codeword is calculated and codeword with the minimum distance is selected.
2 The distance between the input speech and the codebook is a number of minimum distance (equation 1)

$$jarak(input, codebook) = \sum_{t=1}^{T} \min_{\forall codeword_k} d(frame_t, codeword_k) \quad (1)$$

The distance variants in this research used euclidean and mahalanobis distance. Euclidean distance is between object i which defined in equation 2 (Brindha*et al.* 2013). The mahalanobis distance is defined in equation 3 (Gomathy *et al.* 2012)

$$D(X,Y) = \sqrt{\sum_{i=1}^{D} (x_i - y_i)^2} \quad (2)$$

$$D = \sqrt{(x_s - y_s) * C^{-1} * (x_s - y_s)^T} \quad (3)$$

C is a *covariance matrix*, $x = \{x_1, x_2, \ldots x_s\}^T$ dan $y = \{y_1, y_2, \ldots, y_s\}^T$

The testing is done using the testing data for about 35 data and training data for about 140 data. Analyze phase is done according to the result obtained in the testing phase. Analysis is done according to the result of factor combination and level as below:

- Frame length: 25 ms/frame length = 275,
  40 ms/frame length = 440,
  60 ms/ frame length = 660.
- overlap frame: 0%, 25%, 40%.
- the number of codewords/number of clusters: 1 to 18, except for frame length 275 and overlap = 0 using 1 to 29 clusters
- Distance variants: euclidean dan mahalanobis

The accuration value of each combination of factors and levels will be calculated by using equation 4.

$$accuracy = \frac{a\ number\ of\ testing\ data\ with\ right\ identification}{a\ number\ of\ testing\ data} x\ 100$$

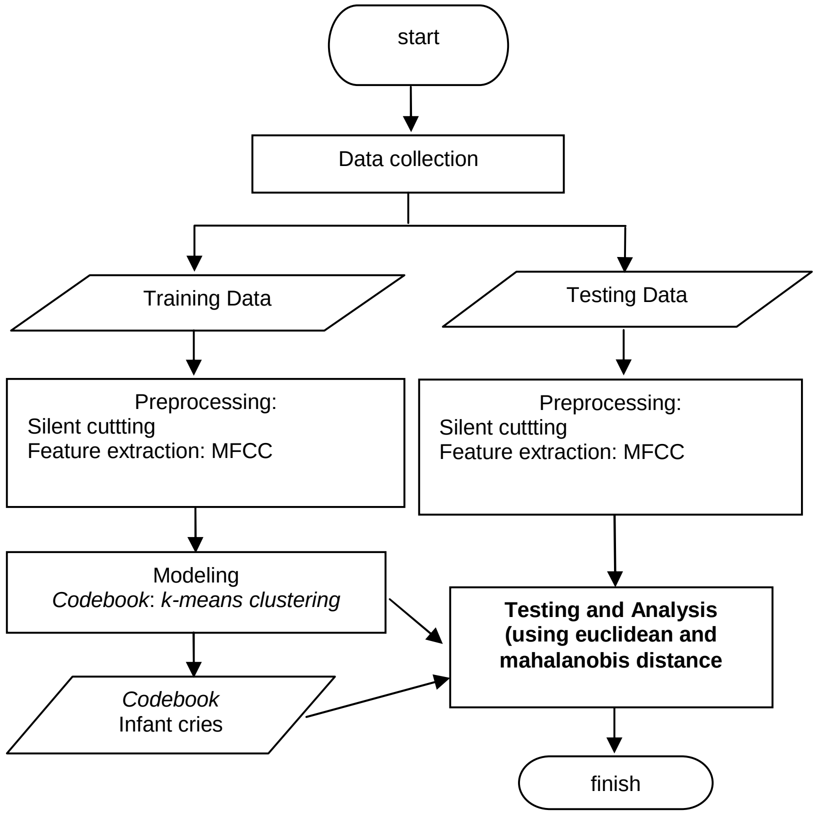

Figure 1: The methodology of identifying the meaning of a crying baby

RESULT

Result of accuracy comparison using Euclidean distance with testing data is shown in Figure 2. According to Figure 2 the higher accuracy when the frame length = 440, *overlap* frame = 0.4, and k =

18 with 94% accuracy. The same accuracy can be got when frame length = 660, *overlap* frame = 0.25, and k = 14.

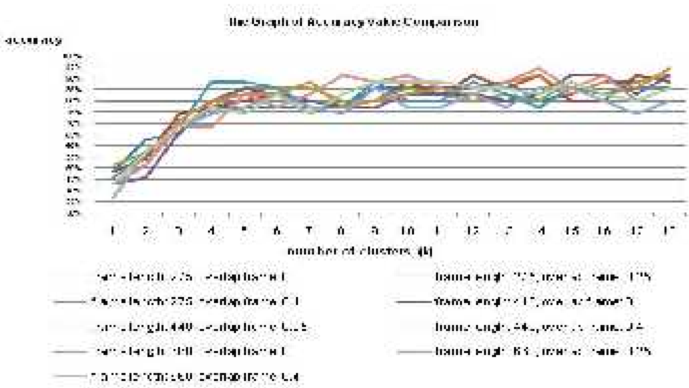

Figure 2: The graph of accuracy value comparison using testing data(Renanti*et al.* 2013)

Accuracy graphic used the Euclidean distance of test training data is shown in Figure 3.

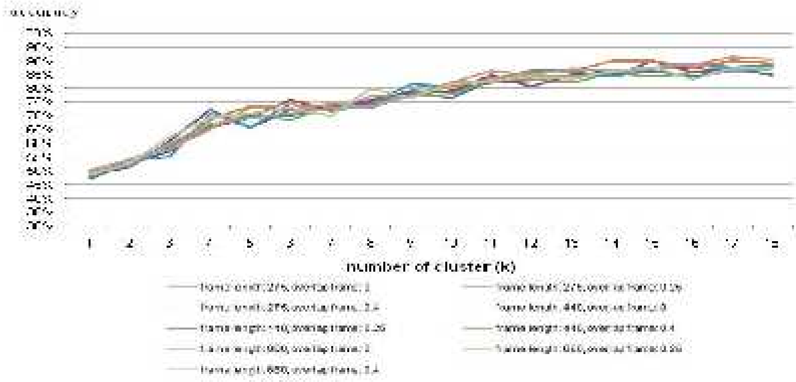

Figure 3:Comparison of accuracy graphic using the Euclidean distance of testing training data

Figure 3 shows that the highest accuracy used in test training data is for about 91%, when the frame length =660, overlap frame =0.25, and k =17. When the frame length =440, overlap frame =0.4, and k =18, the accuracy is about 89% (when using the testing data, accuracy reach 94%).

The accuracy graphic used the mahalanobis distance test training data is shown in Figure 4. According to Figure 4, it is known that the result for the highest accuracy is when the mahalanobis distance test training data is 83%. This highest accuracy is achieved when the frame length = 275, overlap frame = 0.25, and k = 17.

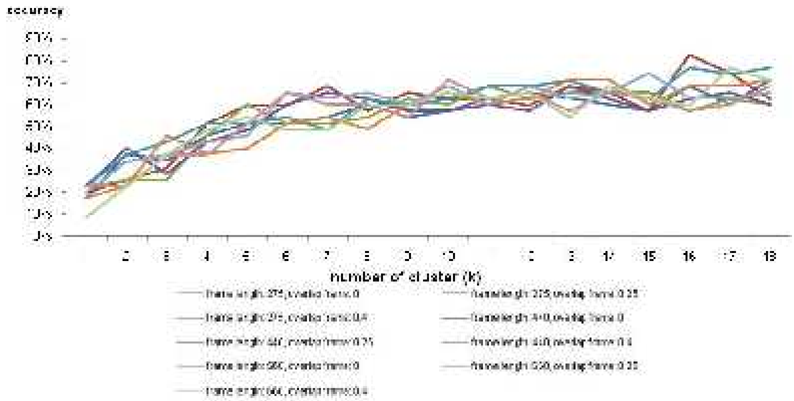

Figure 4:Comparison of accuracy graphic using mahalanobis distance test training data

Accuracy graphic using the distance of mahalanobis test training data is shown in Figure 5. According to Figure 5, it is known that the highest accuracy result is when the mahalanobis distance test training data is 83%. This high accuracy is achieved with frame length = 275, overlap frame = 0.25, and k = 17. The result remains the same when the testing data is used. The range of this accuracy value is generally shown in Table 1.

Table 1: The range of accuracy value using Euclidean and mahalanobis distance

Distance and Types of Testing	Minimum Accuracy Value	Maximum Accuracy Value
Euclidean distance of testing data	37%	94%
Euclidean distance of training data	47%	91%
Mahalanobis distance of testing data	9%	83%
Mahalanobis distance of training data	12%	83%

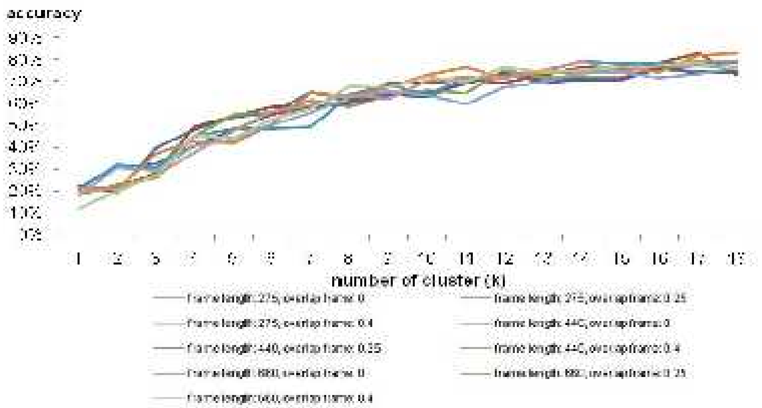

Figure 5:Comparison of accuracy graphic using mahalanobis distance test training data

The difference of accuracy result using training data and testing data are shown in Figure 6 and Figure 7. The different is that the use of Euclidean distance in Figure 6, and the use of mahalanobis distance in Figure 7. Both figures shown a different accuracy result when the frame length = 275, overlap frame = 0, number of cluster (k) = 1 until 29. The number of cluster is created more with the intention of describing the difference.

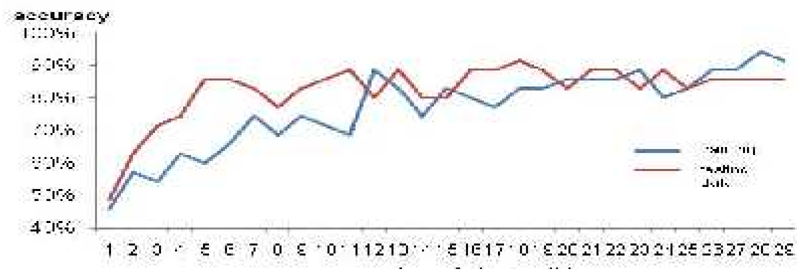

Figure 6:The testing accuracy of training data and testing data using euclidean distance with frame length = 275 and overlap frame = 0

According to Figure 6, it is known that when k < 12, the testing accuracy using the testing data is better than the training data. Meanwhile, when k > 25 the training data accuracy is better than testing data. This means, in a low cluster, the testing data accuracy is higher, while in a high cluster, the training data accuracy is better. This is due to variants of training data compare to testing data, so the accuracy result for the testing data is better when the cluster is low. Low cluster cannot accommodate the training data. However, when the cluster is high, training data can be accommodated so the testing that uses training data will gain a better result. This is appropriate to the basic principal that the training data accuracy is better compare to the testing data.

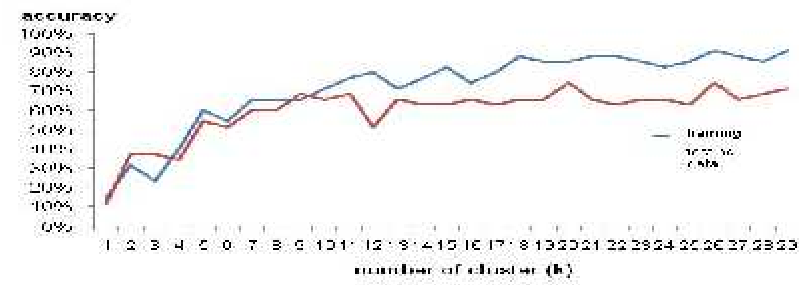

Figure 7The testing accuracy of training data and testing data using mahalanobis distance with frame length = 275 and overlap frame = 0

Figure 7 shows a different result, which is when k > 9, the accuracy using training data is higher that the testing data. This is due to mahalanobis distance that has its variant divider so that the training data accuracy is better.

The other difference between Figure 6 and Figure 7 is the testing when used mahalanobis distance which is more stable. This can be seen when k > 9, the accuracy using training data is always higher compare to the accuracy using testing data. Meanwhile in Figure 7, the comparison of the testing data accuracy and training data is fluctuating until k = 25.

CONCLUSION

The accuracy use Euclidean distance in a range of 37% to 94%. The highest accuracy is achieved when the frame length = 440, *overlap* frame = 0.4, and k = 18 with 94% accuracy. The same accuracy can be achieved when the frame length = 660, *overlap* frame = 0.25, and k = 14. Meanwhile, the accuracy usemahalanobis distance in a range of 9% to 83%.This highest accuracy is reached when the frame length=275, overlap frame=0.25, and k=17. However, the testing using mahalanobis distance is more stable because there is a variant divider in mahalanobis distance so that the accuracy of training data is better.

When the distance of euclidean is used, the accuracy of the observation result will be higher when the cluster is low, meanwhile the accuracy for the training data is better when the cluster is high. This is because the training data is variant rather than the testing data, thus the best accuracy result for testing data is when the cluster is low. The low cluster can not accomodate the training data. But when the cluster is high, the training data can be accomodated so that the observation using the training data is better in result. This result is different compare to mahalanobis distance. When k>9, the accuracy using the training data is higher compare to the testing data.

REFERENCES

Abbas OA. 2008. Comparisons Between Data Clustering Algorithms. *The International Arab Journal of Information Technology*, Vol. 5, No. 3, pp. 320-325.

Brindha M, Tamilselvan GM, Valarmathy S, Kumar MA, Suryalakshmipraba M. 2013. A Comparative Study of Face Authentication Using Euclidean and Mahalanobis Distance Classification Method. *International Journal of Emerging Technology and Advanced Engineering*, Vol. 3, No. 1, pp: 263-268.

Brindha M, Caviraj C, Srikant KS. 2017. Studyof Face Authentication Using Euclidean andMahalanobis Distance Classification Method. *International Journal of Modern Trends in Engineering and Science,* Vol. 4, No. 2, 2017, pp. 30-34.

Deepana R. 2017. On Sample WeightedClustering Algorithmusing Euclidean and Mahalanobis Distances. *International Journal of Statistics and Systems,* Vol. 12, No. 3, pp. 421-430.

Dunstan P. 2006. Open Up and Discover Your Baby's Language.

Gomathy M, Meena K, Subramaniam KR. 2012. Gender Clustering and Classification Algorithms in Speech Processing: A Comprehensive Performance Analysis. *International Journal of Computer Applications*, Vol. 51, No. 20, pp: 9-17.

Linde Y, Buzo A, Gray RM. 1980. An Algorithm for Vector Quantizer Design. *IEEE Transactions On Communications*, Vol. 28, No. 1, pp. 84-95.

Renanti MD, Buono A, Kusuma WA. 2013. Infant Cries Identification by using Codebook As Feature Matching, And MFCC As Feature Extraction. *Journal of Theoretical and Applied Information Technology*, Vol.56, No. 2, pp. 437-442.

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